



079963

VR

Nov

UNIVERSITAS

An Interdisciplinary Journal for the Sciences and Humanities

V.R.D
29/12/92
University of Madras
Mysore
Festschrift

Vol. 34

1992
1-4

C2-C

079963

Essay

ing Fetscher



079963

the GDR

Friedrich Schorlemmer

Tolerance

A timely reminder of a
“minor” virtue

**A Plea for the Establishment of a
Political Tribunal**

**Legal Proceedings and the Dilemma
of the Constitutional State**

Fundamentalism

Martin Greiffenhagen

**Overcoming the Spiritual Void of
our Time**

Love as Identity?

Female biographies in upheaval

Meteorology

Christian-Dietrich Schönwiese

**Are Climatic Changes
Predictable?**

Biology

Roland Prinzinger

**How does the Biological Clock Tick?
Life span and Biological Time**

Interview

Adelbert Reif in conversation with the
Novel prize winner for physics, Gerd Binnig

Thinking as Evolution

UNIVERSITAS

Editor-in-Chief
Dr. Christian Rotta

Editors
Dr. Christian Rotta
Ingrid Jung

Publisher: Wissenschaftliche Verlagsgesellschaft mbH, Birkenwaldstraße 44, P.O. Box 105339, D-7000 Stuttgart 10, F.R. Germany. Tel.: (0711) 25 82-232 or -240; Telex: 723636 daz d; Fax (0711) 25 82-290.

Responsible for Text Material: Dr. Christian Rotta, Birkenwaldstraße 44, D-7000 Stuttgart 10, F.R. Germany. Tel.: (0711) 25 82-233.

Responsible for Advertisements: Klaus Urbitsch, Birkenwaldstraße 44, P.O. Box 105339, D-7000 Stuttgart 10, F.R. Germany. Tel.: (0711) 25 82-245 (263). Present effective rate card: January 1, 1992.

Terms of Delivery: The "UNIVERSITAS. An Interdisciplinary Journal for the Sciences and Humanities" is published quarterly. Subscription annually: DM 48,-, price for single issues: DM 15,-. All prices plus postage. Unless ordered for a specific period, subscriptions will be continued automatically. Cancellations may only be made for a complete annual volume and must be received by the publisher at the latest on 15 November of the preceding year.

The journal and all articles and illustrations published here are protected by copyright. No part of this journal may be translated, reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, microfilming, recording or otherwise, without written permission of the publisher.

All articles published in this journal represent the opinion of the authors and do not necessarily reflect the opinion of the editor. The publisher cannot be held responsible for unsolicited manuscripts.

The use of general descriptive names, trade names, trademarks, etc. in a publication, even if not specifically identified, does not imply that these names are not protected by the relevant laws and regulations.

© 1992 Wissenschaftliche Verlagsgesellschaft mbH, Stuttgart. Printed in F.R. Germany



Typeset and printed by
Weberdruck,
Turnstraße 1 – 3, D-7530 Pforzheim

WVG

Wissenschaftliche Verlagsgesellschaft mbH

UNIVERSITAS

1

1992

EssayToleranceA Timely Reminder of a "Minor" Virtue

Iring Fettscher, Frankfurt on the Main

3

42

The past of the GDRA Plea for the Establishment of a Political TribunalLegal Proceedings and the Dilemma of the Constitutional State

Friedrich Schorlemmer, Wittenberg

13

FundamentalismOvercoming the Spiritual Void of our TimeThe Development of Fundamentalist Currents of Thought

Martin Greiffenhagen, Esslingen

20

PsychologyLove as Identity?Female Biographies in Upheaval

Elisabeth Beck-Gernsheim, Munich

30

MeteorologyAre Climatic Changes Predictable?Christian-Dietrich Schönwiese,
Frankfurt on the Main

42

BiologyHow does the Biological Clock Tick?Life Span and Biological Time

Roland Prinzinger, Frankfurt on the Main 50

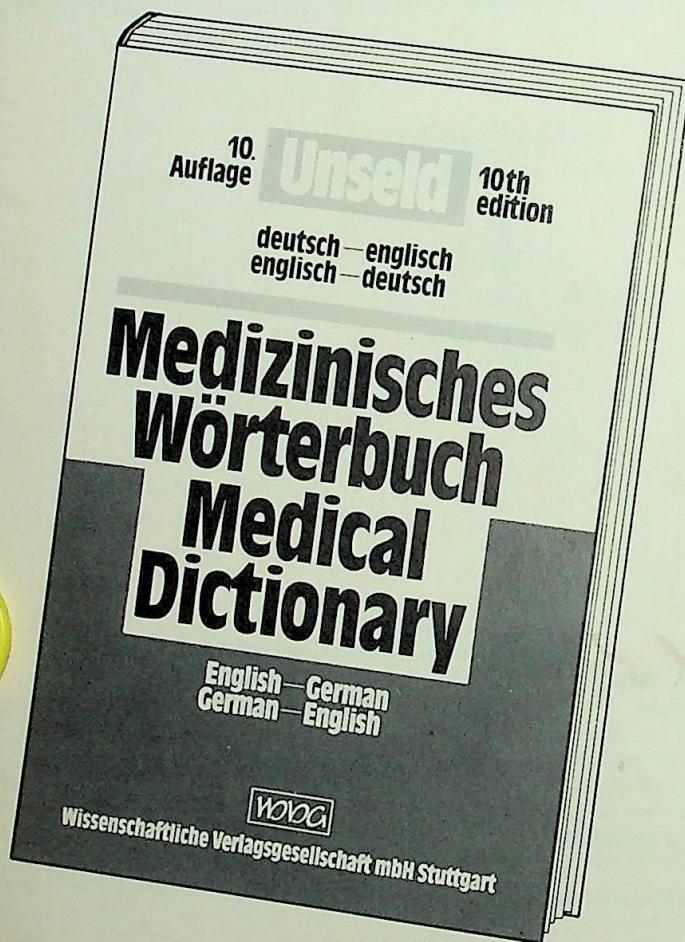
InterviewThinking as Evolution

Adelbert Reif in conversation with the Nobel prize winner for physics, Gerd Binnig 61

Spectrum

among other things: On the Causes of Altruistic Behaviour · When did Man Start Painting? · Is the Universe Twice as Old as We Thought? · A New Prototype of Computer Recognizes Faces · Poison for the Bride — How Plants Protect Themselves from Being Eaten 69

Medical Dictionary of the English and German Languages



New

Medical Dictionary

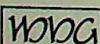
English - German
German - English

Tenth revised
enlarged edition 19

By Dr. Dieter W. Unseld
XII, 700 pages. Handy form
12 x 18,5
Hardcover DM 7,-
ISBN 3-8047-117

Orders placed in
North and South America
should be addressed to our exclusive
distributor: CRC PRESS, INC.,
2000 Corporate Blvd. N.W.
Boca Raton, FL 33431, U.S.A.
Telephone: (407) 994-0563
Or call toll free: 1-800-272-7737

A good medical dictionary must remain up-to-date to remain useful. The new 10th Edition features an abundance of new terms that have been derived from the latest developments in medicine and related areas. The book will be indispensable to doctors, dentists, veterinary surgeons, psychologists, pharmacists, biologists, chemists, physicists, translators, and others who must be familiar with medically related terminology in English and German.



Wissenschaftliche Verlagsgesellschaft mbH
P.O. Box 10 53 39, D-7000 Stuttgart 10, Germany

Yes, I order from Wissenschaftliche
Verlagsgesellschaft mbH, P.O. Box 10 53 39,
D-7000 Stuttgart 10, Germany:

— copy(ies) Unseld, Medical Dictionary
English - German / German - English
10th Edition DM 7,-

Please charge my credit card:
 American Express MasterCard
 Visa Eurocard
 Diner's Club Access

Card No. _____
Expiration Date: _____

Please send me a proforma invoice

Name/Address: _____

Date, Signature

Trans
World
Hans
Polit
Look
Polit
Kurt

Third
Catc
Outli
in De

Biol
Evolu
The H
Franz

Philo
Evolu
Appr
Gerh

UNIVERSITAS

2

1992

age
W
dic
nar
erma
Engli
evised:
dition 19

W. Uns
dy form
x 18,5
er DM 1
047-117

sterCard
ocard
ress
Invoice

<u>Transcultural Ethics</u>	
World Religions and World Ethos	
Hans Küng, Tübingen	79
<u>N.W. Politics</u>	
Looking Forward to Catastrophe	
Politics and the Intellectuals	
Kurt Sontheimer, Munich	86
<u>Third World</u>	
Box 10 53 "Catching up on Development" – a Chance?	
Outline of Modern Problems	
Dieter Senghaas, Bremen	95
<u>Biology</u>	
Evolution – Brain – Consciousness	
The Evolution of Human Consciousness	
Franz M. Wuketis, Vienna/Austria	103
<u>Philosophy</u>	
Evolution and Projection	
Approaches to a Modern Epistemology	
Gerhard Vollmer, Braunschweig	114

<u>Medicine</u>	
Consciousness and the Conquest of Pain –	
Oriental Wisdom and Scientific Knowledge	
Klaus Jork, Frankfurt on the Main	127
<u>Behavioural Biology</u>	
Dangerous Security	
The Behavioural Biology of Risk	
Felix von Cube, Heidelberg	135
<u>Paleontology</u>	
Ecological Catastrophes During	
the Earth's History	
What is the Evidence?	
Heinrich Karl Erben, Bonn	143

Spectrum

Zoology: A Gene Regulates the Ant Colony ·	
New Technology for Electric Automobiles:	
The Rail Goes Along for the Ride · Medicine ·	
Grey Cataract: a Collapsible Lens · Geology:	
The Catastrophe as a Normal Occurrence in	
the History of the Earth	151

World Climates

With tables of climatic data and practical suggestions

By Willy Rudloff, Buxtehude

632 pages. 50 figures, 1474 climatic tables, 116 hygrothermal diagrams, 30 other tables and reviews, 1 bicoloured map on the front-papers. Bound DM 198,-; Special price for subscribers of "Naturwissenschaftliche Rundschau" DM 158,40

About this book

This work draws on the comprehensive collection of climatic data of the WMO (World Meteorological Organization), Geneva, from details supplied by national meteorological offices throughout the world, with the latest figures for the years 1931–1960; the average values of mean temperature, precipitation and sunshine were taken from this collection. In addition, the author has used the extreme temperatures given in the publications of the Meteorological Office, London. Certain further data are derived from the archives of overseas climatology of the German Weather Service in the Marine Weather Office at Hamburg.

All figures given in the tables represent average monthly and annual values for 1474 locations throughout the world:

- Temperature and extreme values
- Clothing tips for travellers (polar clothing, winter clothing, normal clothing, summer clothing, tropical clothing)
- Stress on the human body caused by heat (with indication of average stress by perspiration)
- Amount of precipitation and number of days with precipitation of 1 mm or more
- Hours of sunshine and percentage of possible sunshine
- Within a division into 16 climatic zones (according to Köppen), the physiological effect of temperature and air humidity on the human body can be seen

Furthermore, the book explains in easily understood language:

- the effect of the global wind systems on the various climatic zones of the Earth (with numerous maps and graphic illustrations)
- adaptation of inhabitants of the Earth to the climatic conditions; reaction of the human body to stress caused by heat and humidity (e.g. cooling requirements in tropics); indication of clothing conditions
- Köppen's classification of climates: the system, once used throughout the world, appears again in this book in a more concise form

"This large and expensive volume is clearly intended as a standard reference work of world climatic data and a valiant effort is made to put flesh on the bare bones of the climatic data by means of brief descriptions which emphasize the bioclimatic significance of the data." (*Journal of Climatology*)

Its readers: Teachers and students of meteorology, physics and geophysics — climatologists — meteorological institutes — weather offices — all those with previous knowledge of the natural sciences interested in climatology — industry and agriculture — water supply and building industry — trade and traffic — travel firms, for advising tourists — libraries — institutes

Wissenschaftliche Verlagsgesellschaft mbH
Postfach 10 53 39 · 7000 Stuttgart 10

UNIVERSITAS

3

1992

<u>Politics and Society</u>	<u>Medical Psychology</u>
Peace – Justice –	Spatial and Temporal Environment
The Preservation of the Environment	The Chrono-Ecology of Biological
Carl Friedrich von Weizsäcker, Starnberg	Rhythms
	Till Roenneberg, Munich
<u>Law</u>	<u>Evolutionary Biology</u>
Human Rights vs. Reason of State:	The Narrow Ridge of Life
International Law	The Ecological Challenge of Evolution
On the History of International	Bernhard Verbeek, Dortmund
Institutions	
Otto Kimminich, Regensburg	211
<u>Politics</u>	<u>Spectrum</u>
The Foreign Citizen	Archaeology: How “Modern Man” Came to
Rules of the Game for a Republic of	Europa from Africa · Geoarchaeology: Atlanti-
Many Peoples	c: the Deciphering of a Legend · Genetic
Claus Leggewie, Gießen	Engineering: Foodstuffs from the Genetic
	Laboratory · Crime: The Call for Redemption
<u>Educational Science</u>	Is Getting Quieter · Medicine: Skin Replace-
Useless Education?	ment for Burn Victims · Astronomy: The Heart
Rainer Dollase, Bielefeld	of the Milky Way under Iron Steam · Culture
	Studies: From the Pilgrimage to Modern
<u>Economy</u>	Tourism · Ancient-oriental History: Master
Money and Magic	Farmers Between Euphrates and Tigris ·
The Economic Background of	Philosophy: Unknown Kant Letter Dis-
Goethe’s Faust	covered
Hans Christoph Binswanger,	222
St. Gallen/Switzerland	

Orbis Geographicus 1992 / 1993

World Directory of Geography

Annuaire Géographique du Monde

Edited on behalf of and in co-operation with the International Geographical Union (IGU) by:

Edité en nom de et en coopération avec l'Union Géographique Internationale (UGI) par:

Prof. Dr. R. ABLER (Washington/D.C. - USA) — Prof. Dr. B. J. GARNER (Sydney - Australia) — Prof. Dr. T. GUTTERREZ DE McGREGOR (Mexico - Mexico) — Prof. Dr. R. MAJORAL (Barcelona - Spain) — Prof. Dr. N. V. PETROV (Moscow - USSR) — Prof. Dr. R. P. B. SINGH (Varanasi - India) — Prof. Dr. J. H. SZYRMER (Warszawa - Poland) — Prof. Dr. Wu (Beijing - P. R. China) — Prof. Dr. M. YOSHINO (Tokyo - Japan)

and
Prof. Dr. E. EHLLERS (Bonn - Germany)

1992. XVI, 656 pages
Hardcover DM 372,-

The "Orbis Geographicus" is a publication of extreme value for geographers and all who have a personal interest in geography, as it gives not only the full list of geographical institutions, such as associations and societies, university institutes and administrative services, but also the names of individual scholars. Ever since 1952, the ORBIS has been an indispensable aid to the promotion of international geography. Accordingly, the publication of a new and considerably enlarged edition is to be warmly welcomed. Orders will already be accepted, payment by credit card is possible. Any further informations on request.



Franz Steiner Verlag Stuttgart

P.O.B. / C.P. 10 15 26, D-7000 Stuttgart 10, Germany

UNIVERSITAS

4

1992

The History of Utopian Thought

Political Utopia or

The Contemporary Relevance of the
Idea of Possibility

Frank R. Pfetsch, Heidelberg

Political Science

Utopia and Human Rights

Richard Saage, Halle (Saale)

Philosophy of Science

Order into Chaos?

How Scientific Knowledge Shapes our
World View

Gerhard Vollmer, Braunschweig

Chaos and Complexity

Self-organization in Complex Systems

Bernulf Kanitscheider, Giessen

Aesthetics

The Dictatorship of the Right Angle

The Geometrification of our Realities
Hans-Peter Schwöbel, Mannheim

Ecology

Ecological Sins, Dilemmas and Social Traps

Hans Lenk, Karlsruhe

Economy

Prices Should Tell the Truth

Ernst Ulrich von Weizsäcker, Bonn

Spectrum

Cosmology: Correcting Einstein's Error · Cancer Research: Why are Tumours Malignant? ·

Agronomy: Development Aid for the Sahel Zone · History: The Limes Was Not a Line of Defence Against the Teutons

305

European Monarchy

Its Evolution and Practice from Roman Antiquity to Modern Times

Edited by Heinz Duchhardt, Richard A. Jackson and David Sturdy

1992. VII, 222 pages with 1 colour plate, p.p. DM 86,-

Foreword — R. A. Jackson: Introduction — E. Frézouls: De la *maiestas populi Romani* à la majesté impériale — B. Bedos-Rezak: Ritual in the Royal Chancery: Text, Image, and the Representation of Kingship in Medieval French Diplomas (700-1200) — S. Bagge: Kingship in Medieval Norway. Ideal and Reality — D. Sadler: The King as Subject, the King as Author: Art and Politics of Louis IX — G. Klaniczay: Representations of the Evil Ruler in the Middle Ages — G. Melville: Hérauts et héros — M.D. Birnbaum: Matthias Corvinus in Humanist and Popular Perspective — M.S. Flier: The Iconography of Royal Procession: Ivan the Terrible and the Muscovite Palm Sunday Ritual — L. M. Bryant: Politics, Ceremonies, and Embodiments of Majesty in Henry II's France — H. Weber: Das „Toucher Royal“ in Frankreich zur Zeit Heinrichs IV. und Ludwigs XIII. — D. J. Sturdy: The Royal Touch in England — A. Wolf: Ein „Comic“ für den Kaiser — A. Guéry: L'Image perdue des Rois de France (XVIII^e-XX^e siècle) — D. E. Barclay: Ritual, Ceremonial, and the "Invention" of a Monarchical Tradition in Nineteenth-Century Prussia

Industry and Finance in Early Modern History

Essays presented to George Hammersley on the occasion of his 74th birthday

Edited by Ian Blanchard, Anthony Goodman and Jennifer Newman

1992. 272 pages with 10 figures, 18 tables und 5 plates (Vierteljahrsschrift für Sozial- und Wirtschaftsgeschichte, vol. 98), pp. DM 84,-

International Capital Markets and their Users: H. Van der Wee / I. Blanchard: The Habsburgs and the Antwerp Money Market: the Exchange Crises of 1521 and 1522-3 — R. Hildebrandt, The Effects of Empire: Changes in the European Economy after Charles V — E. Hopkins: A Nobleman and his Debts: John, Second Earl of Bridgewater, 1622-1686 — J. Price: The Bank of England's Discount Activity and the Merchants of London, 1694-1773 — J. Newman: "A Very Delicate Experiment": British Mercantile Strategies for Financing Trade in Russia, 1680-1780 — **Technological Diffusion in the European Metallurgical Industries:** E. Westermann: The Brass-works of the Höchstetter at Pflach near Reutte in the Tirol, 1509-1529 — H. Kellenbenz †: The Gold Mining Activities of the Fuggers and the Cementation Privilege of Kremnitz — J. Harris: The First British Measures against Industrial Espionage — C.-G. Hildebrand: Swedish and Russian Iron in the Eighteenth Century



Franz Steiner Verlag Stuttgart

Postfach 10·15 26 — D-7000 Stuttgart 10

Tolerance

A timely reminder of a "minor" virtue

Iring Fetscher, Frankfurt on the Main

The recent war in the Near East, with its appalling cruelty, has once again reminded us of the fact that fanaticism, intolerance, and refusal to respect religious and cultural differences are by no means simply relics of the past. Not least in European society, in which a multitude of religious, ideological and political convictions are in conflict, it is urgently necessary to promote the „minor“ virtue of tolerance.

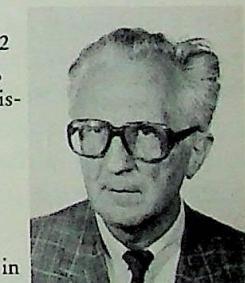
Shortly before Saddam Hussein invaded and conquered Kuwait, Lessing's "Nathan der Weise" was performed in a theatre of that sheikdom; and this was the first time that this drama, a veritable hymn in praise of religious tolerance, had been performed in the Arabic language. Saddam Hussein is said to have felt that the performance of this work, of which the titular role is that of a pious and tolerant Jew, was offensive and something to be condemned. This attitude is, of course, utterly incompatible with the fact that he considers himself to be not only the heir and successor of Nebuchadnezzar but also of Saladin the Great; the Iraqi dictator apparently does not know that Saladin is the second apostle of tolerance in Lessing's drama, in which it is only the Christian patriarch who shows an attitude of fanatical intolerance.

Not only Saladin but many other Moslems as well have been exemplary models of religious tolerance. And alongside passages in which the Christian doctrine of the Trinity is strongly criticized on the ground that it undermines the founda-

Professor Iring Fetscher, born in 1922 in Marbach/Germany, studied philosophy, history and literature in Tübingen and Paris. His career included a period as assistant to Eduard Spranger. Receiving his doctorate in 1950, and his "habilitation" in 1959, he has been since 1963 professor of political science at the university of Frankfurt on the Main. His academic career has included periods as visiting professor in New York (1968 to 1969), Tel Aviv (1971), Nijmegen (1975 to 1976), and Canberra (1976). His numerous publications include:

"Die Wirksamkeit der Träume", Frankfurt 1987; "Überlebensbedingungen der Menschheit – ist der Fortschritt noch zu retten?", fourth enlarged edition 1991; "Toleranz, von der Unentbehrlichkeit einer kleinen Tugend für die Demokratie", Stuttgart 1990; "Utopien, Illusionen, Hoffnungen. Plädoyer für eine politische Kultur in Deutschland", Stuttgart 1990.

Professor Iring Fetscher, Ganghoferstraße 20, 6000 Frankfurt on the Main/Germany



tions of monotheism, there is a passage in the fifth sura of the Koran which almost seems to adumbrate the Parable of the Ring, with which Nathan answers the vexed question of the "one true religion". The true believers (that is to say, the Moslems) but also those who are followers of Judaism, and likewise the Sabians and the Christians, in short, all those who believe in God and in Doomsday and who do what is right, — all these people need have no fear (because of the Last Judgement) and (after the reckoning on the Day of Judgement) they will have no cause for sadness". Does that not mean that Moslems, Jews and Christians, all three believers who revere the God of Abraham, are equal before God and that, therefore, they could very easily afford to have a tolerant attitude toward one another?

In the past, intolerance was by no means a monopoly of the Moslems. On the contrary, the peoples of Christendom have every reason to be ashamed of their religious and ideological intolerance in past ages; certainly they have no right to point a finger of disapproval at others.

The need for tolerance; its meaning

However, our concern here is not a reckoning with the past; it is rather our purpose to show the importance of tolerance, if people of different religious, ideological and political convictions are to live together peacefully in a democratic society. The fact that, in this century, almost all European states have become to an ever-increasing extent multi-cultural societies that have long encompassed a diversity of religious and confessional differences, makes the virtue of tolerance all the more necessary.

Tolerance means a willingness to assume a tolerant attitude. It can be consi-

dered a virtue only when the possibility exists of being intolerant. We cannot speak of a tolerant attitude in the case of a person who, being oppressed and in weak position, is compelled to endure others; such a person, enduring injustice has, in case of necessity, and in accordance with the democratic tradition of the right to opposition, the right to defend himself against oppression and discrimination. Therefore, where it exists, tolerance is, generally speaking, the attitude of people, including government politician in strong powerful positions toward people in less powerful situations; but it can also be the attitude of the dominant majority towards a minority.

There is, however, another kind of tolerance that simply comes from indifference. With this in mind, Goethe advocates going beyond an attitude of mere tolerance of the character of other people different from one's own, and advancing to the point of a proper appreciation of their very different qualities, of the "otherness". It is my wish that the notion of tolerance should be understood in this sense which denotes respect for the nature of the other person and for his right to be different. However, it cannot be denied that the examples of tolerance, or speaking more precisely, toleration to be found in past history did not proceed from this attitude.

Religious toleration and social peace

At the beginning, policies of toleration resulted from an attitude of enlightened statesmanship, an attitude which developed from a perception of the disastrous consequences of intolerance. When it became clear that the imposition of confessional homogeneity throughout the state was incompatible with civil peace, en-

lightened rulers abandoned this policy and granted their subjects "edicts of toleration". Thus, in 1598, Henry IV of France by the Edict of Nantes granted his Calvinist subjects the right to the free exercise of their religion. However, the conditions included in this edict show that the monarch was obliged to take into consideration the intolerant attitude of his Catholic subjects.

The revocation of the Edict of Nantes under Louis XIV in 1685 showed even more clearly than the edict how necessary religious toleration had become for social peace in the age following the Reformation. Through the persecution and expulsion of the Huguenots France was weakened and impoverished politically, economically, and culturally, while, on the other hand, the countries willing to receive these refugees gained very considerable advantages from this policy. This was particularly the case in Brandenburg, where the Elector forthwith issued an edict at Potsdam, thereby compelling his Lutheran subjects to tolerate their reformist co-religionists. Among the later civil servants of the Prussian state, a considerable number of the Huguenots were particularly distinguished.

Frederick the Great proved to be just as tolerant as his grandfather; in a number of different writings Frederick recommended religious toleration as a rule of political wisdom. In 1740 replying to a question from the government administration as to whether a Catholic could acquire civil rights, he wrote: "All religions are equally good, if only the people who profess them are honest. And if Turks and heathen should come to us and populate the country, then we would build mosques and churches for them. In my kingdom everyone is free to believe what he wants, if only he is honest". Of

course, such toleration was easy for an enlightened deist, who took the attitude that the revelations of religion together with ecclesiastical dogma were "humbug". It, nevertheless, remains a remarkable fact that the toleration advocated by Frederick was not limited to Christians. It was, however, Pierre Bayle who first carried toleration to the point of wanting to grant civil rights even to atheists.

Joseph II, in his edict of toleration of 1781, showed the same caution as Henry IV. Though he granted his non-Catholic subjects a carefully delimited degree of religious freedom, at the same time regulating their admission to the civil service and permitting them to receive academic titles, he did not publish this decree, but simply sent it to the competent administrative authorities.

Freedom of conscience

Whereas on the European continent political wisdom was the decisive factor in the development of policies of toleration, in Great Britain this was accompanied by a religious motive. Members of the dissenting free churches, who refused to join either the Catholic church or the Church of England, an equally hierarchical institution, insisted on their "freedom of conscience", which, in the last analysis, could be ensured only by the total separation of church and state. In this connection John Milton insists that deep religious conviction can come only from reading the Bible together with the inner illumination experienced by the individual, and, moreover, that this conviction gives the certainty that one's belief is in accordance with the will of God. He further asserts that such religious conviction must not be weakened by any sort of coercion or seduction. Coercion, which the Protes-

tants reproachfully impute to the Catholics with their belief in the infallibility of the Pope, is, for Milton, an abomination; but he considers seduction equally abominable, as for example, in the preference given to members of certain religious confessions in appointments to public office. However, Milton was not willing to accord equal status to Catholics, although, on the other hand, he had a very tolerant attitude towards Anabaptists, Arians, Socinians and still other people of whose moral conduct and earnestness in matters of religion there could be no doubt.

Hobbes and Spinoza

It is a curious fact that Thomas Hobbes also played a role in the history of toleration on religious grounds. As we know, Hobbes advocated the complete subordination of the church under the sovereign state on the ground that this is necessary in order to prevent civil war between the different confessions. And yet, even if the "confessio", the public creed, is in the domain of the sovereign, he cannot properly determine a person's "inner" belief, the "fides", as this by its very nature is necessarily free. This distinction, made by Hobbes in the interest of the freedom of one's inner belief, was severely criticized by Carl Schmitt in his book, "Der Leviathan in der Staatslehre des Thomas Hobbes", 1938. According to Schmitt, Hobbes, by making this distinction, has put a deadly germ into the mighty Leviathan. On the other hand, Spinoza, bearing in mind this distinction, would permit the public discussion of different religious belief on the ground that a situation in which an inner belief remains unexpressed can hardly give satisfaction.

In chapter 20 of his "Tractatus Theo-

lico-Politicus" of 1670 Spinoza remarks in this agreeing with Hobbes, that uniformity of belief is something that cannot be enforced. "What cannot be prevented must be permitted". And this principle is all the more important in matters of belief and free judgement, as in this domain we are concerned with a virtue that is indispensable for the development of art and science. If the expression of different opinions were suppressed by the state, then people "would regularly think differently from the way they speak, with the consequence that the reliability and loyalty that are so necessary for the preservation of the state would be destroyed; and this would lead to the development of detestable hypocrisy and perfidy". Today, after all our experiences with totalitarian regimes, we know that it is precisely because such governments can no longer trust their subjects, after having forced them to become hypocrites, that these governments make use of secret police and carefully trained informers in order to find out what people are really thinking. We see, then, that the suppression of freedom of belief and opinion leads to the additional evil of spying on people and denouncing them.

To these remarks Spinoza adds a number of further observations, which will be confirmed by anyone who knows from personal experience what a totalitarian state is like. The more freedom of speech is suppressed, the greater will be the opposition of at least some people to this policy. This opposition, of course, will come "not from the hangers-on or from people who are grasping or stupid, but rather from those people of good education and upright character, blameless in their way of life, for whom freedom is a necessity". "Can one imagine a greater disaster for a state than that honourable

men should be exiled as though they were criminals simply because their opinions are different and they are not willing to behave like hypocrites; and that they should be considered enemies of the state not because of some terrible crime but simply because they desire freedom?" When a few years ago in east Germany I quoted these words, which have come down to us from the 17th century and called attention to the fact that Marx himself as a young man had excerpted them, I had some difficulty proving that I had not myself made up these quotations, so accurately did Spinoza seem to have anticipated the prevailing conditions.

No reason for self-righteousness

For people who profess a religious belief the problem of tolerance is closely bound up with monotheism. The polytheists of classical antiquity saw few problems in the coexistence of different religious beliefs, if one leaves out of consideration the cult of the Roman emperor, which was political rather than religious. It is true that the polities of the ancient world were not really quite as tolerant as some people would have us believe; Socrates was even put to death because he relied on his "daimonion", the voice within him, which was incompatible with the gods of the city of Athens; yet the fact remains that monotheistic religions based on revelation do intensify the problem of the justification for tolerance. It is, unfortunately, not possible to maintain that the Christian churches have always been tolerant; nor could this be maintained of other monotheistic religions. The history of the church contains innumerable examples of the sanguinary persecution of different sects and of "deviators" and heretics, of violation of the conscience and

physical torture. On the other hand, the quotation from the fifth sura of the Koran given above is in itself an indication that Islam was not always an intolerant religion. At the time of the Ommiads on the Iberian peninsula between 756 and 1030, the Islamic rulers tolerated Jewish and Christian communities, and this period saw an incomparable cultural efflorescence of the three cultures. This period of tolerance came to an end with the reconquest of the peninsula by the "Christian West". The forced baptism of Jews, the burning of heretics, and finally the "Holy Inquisition" are very far from being glorious pages in the history of Christian tolerance, and the Protestants with their burning of witches were hardly any better. I mention these facts simply by way of warning against self-righteousness, a self-righteousness which, based on the degree of tolerance shown by the Christian churches at the present time, sees intolerance only in the Moslem fundamentalists.

Since the encyclical of John XXIII, "pacem in terris", the popes have repeatedly called for tolerance, a tolerance that would transcend the limits of the Christian church. The guiding thought in these calls has been the realization of a common responsibility, shared by all believers, both for the preservation of the ecological environment and the establishment and preservation of peace.

The Catholic theologian J. B. Metz has described the mission of his church in a world of "cultural polycentrism" as follows: "The church must be guided by two options, if it is to be equal to the challenge of cultural polycentrism without denying its own character. It must be guided by an option for the poor and an option for other people in their otherness. It must be culturally concrete both in a

political culture of freedom and justice for all, and in a hermeneutic culture which is willing to accept others in their otherness." In other words Metz combines the demand for an equalization of burdens, both within society and throughout the world, with the demand for the tolerant recognition of the legitimacy of foreign cultures. The two demands belong together and are legitimate only when combined. The equalization of burdens must not lead to the destruction of cultural identities, and mutual tolerance cannot be expected without an equalization of living conditions. To accept subordination, poverty, and cultural humiliation, which are often residual phenomena of colonialism and neo-colonialism, is not the expression of tolerance but simply the endurance of weakness.

Certainty of belief and capacity for tolerance

No one has answered in a more illuminating way than has the Protestant theologian Paul Tillich the difficult question, so agonizing for all religious people, as to how the strength of one's belief can be reconciled with a spirit of religious tolerance. "The kind of tolerance which is pure relativism, an attitude which demands nothing that is unconditional would be negative and without significance; it is open to the fateful possibility of changing into something contrary to itself, an intolerant lust for power". Contrary to the kind of tolerance that comes from indifference and relativism, Christian belief should unite two things: the tolerance which is aware of the conditional nature of each particular belief, and the certainty that is grounded in the unconditional. According to Tillich, true Christian belief involves self-criticism and

the courage to recognize one's conditional nature and limitations. In his view, tolerance arises when the mere symbol of the unconditional, (a symbol that is necessarily inadequate in view of the limitations of human thinking and imagination), is regarded as itself being the divine essence. Thereby the symbol acquires a demonic character. This is something that has happened time and again in religions, even in Christianity notwithstanding the fact that the symbol of the cross is "a sign of the opposition against the self-elevation of a particular religion to the unconditional". Only by means of this line of demarcation between the aspects of religion — the belief and the form of expression of this belief —, a line which is difficult to draw, yet necessary, is it possible to avoid fanaticism while at the same time preserving the inner certainty of one's belief. It is only when Christians in this way show that they affirm in their belief yet at the same time are capable of tolerance, that they are able to make their contribution to a free society. Mysticism in all religions may be considered an attempt to transcend the limitations of symbols. In this connection it is interesting to note that mystics have usually been tolerant people.

The right of cultural identity

Calls for tolerance together with discussions of intolerance in modern industrial societies are usually less concerned with different religious denominations than with different ethnic and cultural identities. (However, we cannot overlook the fact that even today there are conflicts very largely caused by matters of religion, as, for example, in Northern Ireland. One might also mention the presence of Islamic minorities in predominantly Chris-

tian societies.) Yet the paradigm of religious tolerance remains relevant, for, in relations with people belonging to different cultures with different ways of life, what is needed is an open-minded willingness to accept and to respect these differences. Many years ago, in a critical discussion with reference to Dorothee Sölle's "Recht ein anderer zu werden" (Right to become another person), I once formulated a "right to be oneself", that is to say, to preserve one's personal identity. These two rights are not incompatible. Free from coercion and external pressure, everyone should have the right both to preserve his cultural and individual identity and also, if he so desires, to become something different. The decisive factor should be free self-determination; no one should be manipulated, overpowered, coerced or intimidated. Cultural assimilation is legitimate only when it is voluntary. If the right to maintain one's cultural and ethnic identity is to be preserved, then acceptance into a national entity cannot be made dependent on total assimilation. It is, of course, true that a certain degree of adaptability and flexibility is very helpful in improving one's position in a society whose majority belongs to a different culture, but that is another matter. On the other hand, all due recognition of the right of people to cherish their ethnic and cultural origins cannot justify the formation of ghettos and sub-cultures.

Relations with minorities in a democracy

While it is true that the need for tolerant behaviour towards ethnic minorities belonging to a different culture presents a new challenge for many states which hitherto have been ethnically and culturally homogeneous, yet on the other

hand, relations between majorities and minorities have always constituted a central problem of democracy. Contrary to an abstract ideal of democracy that goes back to the Jacobin tradition based on Rousseau, the liberal democratic tradition in England and the United States at a relatively early date recognized the necessity for legal opposition parties. This meant that the majority party had an obligation to tolerate the defeated minority party. It was understood that, without such toleration, the power of the majority at any particular time could lead to dictatorship. Such toleration means, among other things, that decisions and measures taken by the majority, including legislation, may still be publicly criticized. Any attempt to give majority decisions an absolute character would amount to a negation of their conditional nature. Toleration provides the criterion by which the decision of the majority is to be realized and interpreted.

In all this the majority bears a responsibility for the defeated minority. It has the right to demand that its decisions be respected only within the framework of its lawful authority to enact legislation, which does not affect the independence of minorities and of their opinions. Decisions should not be made with a view to compelling the absolute and unconditional agreement of the minority to everything that is in these decisions. (Trutz Rendtorff). The minority must, of course, respect the decisions of the majority, as, for example, by obeying the laws that have been enacted; but this does not mean that it must be in full agreement with these decisions. It still has the right, by information and propaganda, to advocate a revision of the decisions made at the time of another election. Majority decisions must, therefore, be of such a nature that they can be tolerated.

The legal possibility of forming new majorities means that the majority of any particular time has no right to do everything in its power to prevent such a change, even if it, of course, cannot desire it; the ruling majority must, on the contrary, accept this possibility as a matter of principle. It is a sign of what may be called structural tolerance in a commonwealth, when a change of government is permitted by law and becomes possible in reality. Indispensable conditions for this "real possibility" are freedom of information and of the press together with freedom of organization and demonstration. In order to compensate for the extra-legal premium which the government enjoys simply by virtue of the fact that it is in power, the rules of procedure of the British House of Commons expressly grant to the party of the opposition more time to speak than to the government party on important occasions, such as a declaration of government policy or the voting of the budget.

For minorities that never can become majorities, federalism is important as an institution to ensure that toleration will be extended to them. In this connection Werner Kägi has said: "Federalism is an order which makes it possible for minorities to live together in freedom. It is based on the tolerance of the majority towards minorities that are different in nature, and on the mutual respect of different minorities towards one another... A minority is protected not by a special statute, but by the law and order of a federative entity. By requiring tolerance towards minorities and protecting their rights, a federative form of government moderates in a salutary way the democratic absolutism of the majority principle." The right of self-government within the framework of a federation is, for ethnic

minorities such as the population of cino or the French-speaking part of Szerland, a compensation for the fact they will never constitute a majority.

The limits of tolerance

Are there limits to tolerance? Should even groups, parties and sects which themselves intolerant be tolerated? First of all comes the necessity to avoid violence; controversy must be carried on peaceful means. At the same time, however, demonstrations (including political strikes, at least in special cases) must be accepted as a means of expression for certain groups within the population who have no other way of making their opinions and wishes known with sufficient emphasis. There is a need for toleration regarding expressions of opinion; this however, does not mean that violence should be tolerated. John Rawls in his book, "A theory of justice", gives a detailed discussion of the question of the tolerability of intolerant people. In order to find a right answer to the question whether intolerant people should be tolerated, Rawls divides the question into two parts. There is first the question whether intolerant groups have a right to complain when they themselves are not tolerated; and then there is the second question whether tolerant governments (or groups) have a right not to tolerate those who are intolerant. The first question can be easily answered with reference to the Golden Rule. Intolerant groups have no right to complain when they, in turn, are not tolerated. However, it does not follow from this that governments or groups having a policy of toleration should always treat intolerant people in an intolerant manner. The question to be considered is whether the fact that, for

example, some individual or some party advocates principles of intolerance provides a sufficient ground to limit the freedom of this individual or this party. This would be legitimate, when it is the only way of ensuring the safety of people who practise tolerance. Rawls takes the position that a social order can be considered just only when it can be accepted by everyone from the viewpoint of what he calls "the original position". By the original position he means the uncertain situation in which anyone would find himself "behind the veil of ignorance". A person in this situation would then pass judgement on a social order without knowing what his own position in it would be; whether he would belong to a minority or to the majority, to this or that religious confession, class of society or what not. This person would consider only that social order just and fair in which even those people who are most disadvantaged can still live passably well and in safety. "Justice does not require that men must stand idly by while others destroy the basis of their existence". It goes without saying that everyone has the right of self-defence against threats to his own freedom. However, in a case where the intolerant group or party does not represent such a threat, the question is somewhat more complicated. It is Rawls's belief that when the continuing existence of a just constitution is not threatened, it is better to tolerate the intolerant group in question. "Just citizens should strive to preserve the constitution with all its equal liberties as long as liberty itself and their own freedom is not in danger." These just citizens, of course, might be able to convince members of an intolerant group that they themselves in "the original position" would have accepted the principle of reciprocity (the Golden Rule) and that,

therefore, they have no right to complain when they are obliged to respect the freedom of others. In any case, it is Rawls's position that "when the constitution itself is secure, there is no reason to deny freedom to the intolerant". According to his experience, with such far-reaching tolerance there is a better chance of educating intolerant people to tolerance than would be created by governmental coercion.

International equalization of burdens

Human beings are not tolerant by nature. Psychologists and, in particular, psychoanalysts have repeatedly called attention to the fact that tolerant behaviour can only develop together with a successful adjustment to society. We all have a tendency towards intolerant and aggressive behaviour; we all must constantly engage in critical reflection on our own behaviour in order to develop at least a minimum of tolerance. Intolerance is a reaction to the feeling of one's own weakness and inferiority. Fanaticism is an attitude in which alleged convictions are combined with illusions of omnipotence; it represses and compensates for one's feeling of insecurity. Tolerance, on the other hand, requires self-confidence, and the ability both to control one's impulses and to abandon comfortable prejudices. Therefore, people who are disadvantaged, marginalized, oppressed and victims of discrimination are hardly able to develop a tolerant viewpoint. J. B. Metz was, therefore, altogether justified in asking the Christians of the most developed countries to make earnest efforts to put an end to social injustice. One can neither expect nor legitimately demand tolerance of human beings, who throughout their lives have experienced only the humiliation of misery and subjection. Only

when social conditions obtain that are at least half-way just, together with a large-scale equalization of burdens between the poverty of the Third World and the prosperity of the advanced, industrialized countries, can we hope for tolerance in international relations. Justice is the cardinal political virtue with which the thinking of political philosophers has always been concerned; and justice must now be realized throughout the world. Only in a just world can tolerance be expected of all individuals and societies. But, in the meantime, this consideration should not keep us from practicing tolerance in the environment in which we live. In the multi-cultural societies, which are now developing almost everywhere in Europe, a tolerant attitude of the majority (that is to say, of the ethnically and culturally predominant elements of the population) towards the numerous minorities is a necessity. The prohibition of discrimination because of race, sex, or religious confession is not sufficient for this. Over and above this, one must respect the right of other people to be different and to preserve their own cultural identity, along with whatever degree of adaptability may be required of them. Only on this condition will the human dignity of people of other cultures be adequately respected.

It is not always easy to establish the limit of what is to be tolerated with regard to certain practices which diverge so

sharply from our conception of human rights and freedom. The demand for equal rights for all people living on the territory on which our constitutional law is valid is something that we cannot easily give up. In taking this attitude we assume that people of other cultures, if only they were free, would appeal to the human rights guaranteed in the constitution. The spread of norms that are intended to be universally valid, as these norms are enshrined in declarations of human rights, is, to be sure, best achieved by example and demonstration. However, in cases of serious violations of personal liberty, the host country is obliged to intervene in favour of oppressed individuals (as, for example, women and children). But there are other matters, such as wearing a veil — just to mention one recent case in France — which will not be considered an offence of this kind. External signs of one's religious confession are not forbidden to followers of other religions; otherwise Christians, for example, would not be allowed to wear a cross on the breast. It is only in cases of flagrant violation of human rights — as, for example, the imprisonment of Moslem women — that the toleration of foreign customs must cease. We see, then, that tolerance is an indispensable virtue, yet one that it is by no means easy to practice, and one that cannot be applied without discrimination.

English translation by Greeley Smith

A Plea for the Establishment of a Political Tribunal

Legal proceedings and the dilemma of the constitutional state

Friedrich Schorlemmer, Wittenberg

What should we do about the crimes for which the regime of the German Democratic Republic was responsible? Can the politicians of this regime and their followers be brought to justice in a way commensurate with their misdeeds by the procedures of criminal law?

Friedrich Schorlemmer, theologian in Wittenberg, and a courageous, outstanding figure on the territory of the erstwhile GDR, advocates the establishment of a political tribunal to come to grips with the problems left by the past years of the GDR.

Following the peaceful course of the upheaval, there is now arising on the territory of the former German Democratic Republic a desire for reparation, even for vengeance; it is a desire that is not yet satisfied and that it would be difficult to satisfy. There are many who say that those people who trampled upon the constitutional state now have no right to lay claim to the privileges and rights of such a state. Yet that is what the rulers of yesterday are now doing with a certain shamelessness, notwithstanding the fact that the United Socialist Party, the party of the GDR regime, had utterly destroyed the so-called bourgeois legal culture, replacing it with a system of law that could be manipulated in accordance with political considera-

tions, a system of law that, in reality, was nothing more than a compilation of directives for political action. These directives could at any time be put into practice or not, according to the decision of the party, conceived as the supreme legislator of history. In the GDR political opportunism was the only thing that counted in carrying out the law. There were times when this was an advantage for some, and for others a disaster.

Until the very end the officials of the party together with their henchmen in the state, in political organizations, in the economy, in the sciences and, to some extent, even in the field of culture, extol-

Friedrich Schorlemmer, theologian, has been since 1978 a lecturer at the Evangelical Seminary in Wittenberg, and is now also director of studies at the Evangelical Academy of Saxony-Anhalt. His publications include "Träume und Alpträume – Einmischungen", 1982 to 1990 (1990); "Bis alle Mauern fallen – Texte aus einem verschwundenen Land" (1991).



Friedrich Schorlemmer, Collegienstraße 54,
4600 Wittenberg/Germany

led the GDR as the outcome of the greatest revolutionary event in German history, as a social order that would prove its superiority with ever increasing strength, a social order that was constantly rising to new heights and approaching nearer to perfection. Yet the truth of the matter is that there is hardly a crime of which this state was not guilty. It was the perfection of evil and perversion in its apparatus for spying and defamation by which, in every possible way, human beings were ruined physically, psychically and mentally. It provided hiding-places for terrorists, sold off weapons for use in war zones, permitted the use of the Schönefeld airport as a centre for trade in drugs, shot fugitives, erected establishments similar to concentration camps, and prepared for the use of sharpened harvester-cutters on vehicles deployed against demonstrators. It literally encompassed all people with an ideology of domination whose counterpart was the wall. According to the required belief, all that remained for this state to do was to make further improvements. Socialism was becoming stronger all the time; stronger, more attractive, more beautiful, flourishing ever more in all its various manifestations. In short, the good had already been achieved. It now remained simply to add the finishing touches. Anyone who said anything about the need to improve socialism was regarded as an enemy. This system was the embodiment of political totalitarianism. As people were filled with fear, a feeling to which they were already accustomed from the years of the Nazi dictatorship, it was, in many cases, not necessary for the government to make use of the means of coercion at its disposal, and which it was always ready to apply; this fear was, in itself, sufficient to maintain discipline.

A mixture of fear and conviction

Fear led to the obedience of millions. Trials which took place from time to time, together with interrogations, black parentheticals, and expulsions, provided object lessons showing what the state could do to an individual, should the occasion arise. A Pervading fear, so, the state had almost everyone under control. The feelings of the people were compounded of fear and conviction, and this was true even of political activists. Yes, the state security apparatus was, on the one hand, the instrument of the domination of the party; yet, on the other hand, this apparatus at the same time ruled over the members of the party. The process of warping the character of the people was carried so far that, at regular intervals, they were called upon to publicly declare their agreement with the government. Folding the slip of paper at the state ceremony which was called an election, and responding to the genuflection before the statue of the Kaiser. Anyone who did not make this genuflection thereby showed himself to be an opponent of the regime. An overwhelming majority of 99 per cent regularly took part in this humiliating ceremony, for everyone had something to lose by not doing so. There was always the thought that the all-powerful government agencies might deprive one of such most rights as, for example, the authorisation for one's line of work, for admission to a university or travel to the West. The citizens were organized, and more than 90 per cent of them in organizations of the masses. Most of the people in the mass organizations were simply paying obedient numbers. Individuality was suppressed as an interference. The majority of the citizens never lost an opportunity to express agreement, to affix their signatures as desired by the authorities, to pledge allegiance to the socialist state,

to have their children speak at the youth initiation ceremony, though later there might be a celebration with the god-parents from the West. The lie had become so natural and matter-of-course do to that it was no longer recognized as such.

For many the choice was simply between going or remaining. To remain then usually meant to adjust oneself to the situation, and to do whatever was most necessary for this; otherwise to see to it that one somehow managed to get along in private. The maxim of such people, expressed or unexpressed, was, "Rather a private life than a catastrophe".

The whole system has now been overthrown and has collapsed. Everything that one touched crumbled into pieces. It became clear that one's whole existence had been based on falsehood. Carefully cultivated taboos, as, for example, those involving hostility to foreigners and strangers, are now having bitter consequences. Peace at home is thereby endangered; likewise the repute of Germans abroad. The word solidarity was misused in a way that entailed the utilization of the contributions of the working population for improper purposes, and this is now having far-reaching consequences detrimental to an awareness of true solidarity, and this in a world in which, if it is to survive, such awareness is urgently needed.

The desire for vengeance

The most complicated problem, it seems to me, arises from the fact that the social-

ism of the government of the German Democratic Republic was simply a variant of Lenin's Chekism. It appealed to the deep yearnings of humanity, playing fast and loose with them. This has resulted in the greatest long-term damage in that the willingness of people to work for objectives that go beyond their personal interest has declined. It is only today, now that the system has collapsed, that the majority seem to perceive the consequences for which it was responsible. Some people, who in the past turned a blind eye to the situation, now seem for the first time to be willing to see things as they really are. A feeling of fury is arising. This leads to hate and the search for victims. If one does not have the strength of character to look into oneself and to ask what one's own involvement in the system has been, (whether in what one has done or left undone), this necessarily leads to the search for objects for one's hate; the only alternative would be self-hatred. But this hatred, resulting from the desire for vengeance, is directed against certain individuals regarded as symbols of the system of which they were the leaders. The constitutional state is expected to provide for the appropriate concrete penalties, when moral indignation calls for this, but it cannot satisfy a general desire for exoneration. From a legal viewpoint, only the proof of the individual's guilt on a sound legal basis is relevant. It is not possible, simply on political grounds, to outlaw those people who were the supporters and pillars of the system, for this would mean going back to the very same conception of law that was the basis of the communist ideology. At the present time the measures undertaken with a view to exoneration or revenge are particularly directed against Honecker, Mielke, Kessler, Mittag, Tisch and Wolf. But in the trials

that have hitherto taken place, as, for example, those against Götting and Tisch, embezzlement and misappropriation were the only matters that could be dealt with. The offences with which they were confronted, and for which they were condemned, were ridiculously insignificant when compared with all that they have to answer for.

Commands: the responsibility from origin to execution

The police state of the GDR was a grave aberration of the human spirit, even if with labels proclaiming great humanistic ideals. We are now confronted with the task of coming to terms with our present situation and of carrying out the transformation into a market economy within the framework of a social democracy. A careful study of the past is necessary, in order to make a recurrence of this and similar dictatorships improbable. This, however, presupposes an analysis of the system together with a willingness on the part of the people who belonged to it to consider very carefully the extent to which they were themselves involved.

It is, of course, right and necessary that Herr Honecker, Herr Mielke and Herr Schalck should be brought to trial, and not simply because of their private misdeeds of embezzlement, but because of their violation of the most elementary human rights. The superior officers of the State Security Service should also be arraigned. There remains the further question whether the legislators should not also be brought to account, as they enacted and acquiesced in laws that were a perversion of justice. In any case, it is not sufficient to take legal action, on the one hand, against a few symbolic figures at the top and, on the other hand, against

the guards at the border who carried out the orders they had received. As one has a hand in the mechanism of a dictatorship, the man who gives the orders is as guilty as the legislator who enacts them and, at the other end, the person who carries them out. The question where to put the border-line between legality and morality is extremely delicate and complicated. What, for example, should be said to parents who, so far as their grown-up children would have the possibility of, say, university study or apprenticeship in motor vehicles, were in favour of having them serve for three years in the People's Army of the GDR which, in some cases, meant doing time in the so-called "service for peace" on the border?

Should Honecker be held responsible for everything?

Together with its many crimes, what already known or still to be ferreted out by the government party of the GDR systematically destroyed an idea of humanism that was on its way to realization. Yet, in doing so, it was always concerned with its own conception of the good; moral thought of any possible improvement in its actions reviled as revisionism. Now it would be right to make Honecker responsible for everything, just as many people after 1945 wanted to make Hitler responsible for everything. Honecker was the highest functionary in a state of functionaries in which people had to function in accordance with putative historical laws. The political avant-garde of the working class maintained that it was simply carrying out the course of history, which it had certainly been determined by scientific means.

"Honecker is responsible for everything", I hear people say. I ask, "Didn't

have at least one rogue with him?" Yes, he had many rogues with him, major and minor ones all together, bakers and type-setters included. Life in this system was a life with no alternative; it required tremendous courage to break away from it. For the sake of the future of the constitutional state it is, therefore, necessary that those who bear the prime responsibility for what happened should be put on trial. It is further necessary that these trials should reveal what each individual did or tolerated, and in what circumstances with regard to the attendant violation of the most elementary human rights. However, these illegal trials, based as they are on positive law, cannot do justice to the whole significance of the issues involved. I, therefore, advocate the establishment of a political tribunal.

sponsi

The structures of responsibility

One of the basic tasks of such a tribunal would be the analysis of the Leninist, Stalinist, centralized type of socialism in its structures and functioning, its intellectual background and practical effects, and its ideology of domination with its specific moral pretensions and the justification of its actions in terms of strategy, tactics and dialectics. Such disclosures should be aimed at the general public, as the whole of society has suffered deep and long-term psychological harm; the moral void is incalculable and the economic, ecological and political legacy appalling. Such a tribunal would have the task of ascertaining precisely where responsibility lay for legislation. From this viewpoint it would pass in review schools, parties, elections, and the authorities in charge of defence and security. The destruction of the principles of the constitutional state and of legality must be laid bare together with the

offences committed by penal organizations. The secret political trials must be analysed. Other matters to consider are the concealment of political crimes of international proportions, and the decision to classify information about the environment as secret, notwithstanding the fact that this is a matter of concern to all citizens. In all this, it is not only the leaders of party and state who should be called to account; the tribunal should also interrogate scientists, pedagogues, managers and ecologists. On the other hand, it should not be forgotten that the ultimate objective of this political system was the establishment of an international order of peace and social justice, and that it aimed to profit from the lessons of history in its consistent opposition to fascism. The party had undertaken to liberate mankind from all evils. The motives of its actions were not *eo ipso* reprehensible; it was the attempt to justify crimes, professedly committed for the benefit of humanity, that was reprehensible.

The political tribunal would also show how this system functioned nationally and internationally, and would reveal the mechanisms and compulsions of the Cold War that were operative on both sides. What were the pressures to which the policy of détente was exposed? How and why did politicians of the West become the allies, whether willingly or not, of people guilty of political crimes? What contacts among politicians and what concessions were justifiable or not? What were the purposes of the various business arrangements that were carried out and what were their consequences?

The cathartic function of the tribunal

It would be out of the question to condemn the sixteen million Germans who

remained in the East, or to lump them all together as irresponsible or irreparably damaged by the system under which they lived. The fact is that it was here, under the more difficult conditions prevailing, that many people learned the value of upright behaviour. Social concern, human warmth, and a feeling for justice were also to be found.

The tribunal should be convened by the President with the approval of the Bundestag and Bundesrat. All relevant elements of society including the trade unions, the churches, and scientific institutions, etc., should take part in it. The tribunal should be under the direction of representatives of legislative and executive powers as also of powers of jurisdiction. In view of the fact that the consequences of the Stalinist type of socialism and its derivatives were not limited to the GDR, the tribunal would be well advised to invite experts and personalities of international standing to take part in it. The political tribunal would be able to do its work only at the side of trials based on positive law, but it could have a cathartic function in a way that exemplary trials of individuals could not. Investigations, carried out either previously or concurrently, would provide the basis for the interrogations, to which representatives of the system at all levels should be summoned or invited.

Simply searching for scapegoats, far from being helpful, is, rather, an obstacle to coming to grips with the essential questions, something that is so urgently necessary. On the other hand, looking deeply into oneself helps to stabilize democracy, to reintegrate people who have been cast aside, and finally to prepare the way for reconciliation.

"The blessing of western birth"

Finally it must be remembered that history of shortcomings and wrongs in Germany did not begin on October 7, 1949; this history goes further back and must take into consideration the events of January 30, 1933 and the ensuing consequences down to the present day. Finally, both for our sake and for that of our neighbours, it is not right of Germans to call themselves the "victorious West Germans", who either enjoyed the "blessing of western birth", or escaped to the West while it was still possible, should, for a long time to come, be in a better position, morally and economically, than those who remained here, some of them collaborating with the system in honest belief, though others with evil intent. In any case, there should be no witch-hunting of communists, for it is undeniable that even in the criminal organization, the United Socialist Party of the GDR, there were many upright, trustworthy people, who, though broken down by their experiences, could still make valuable contributions to the reconstruction of our country in the years that lie ahead. This consideration is often ignored by people who want to soothe their own guilty conscience by pointing to the party and making it responsible for everything. What would we gain if, in a victory over this communist dictatorship, we behaved towards the losers as we have behaved towards us? Honesty requires us to acknowledge the multifarious entanglements in which we, in East and West alike, have been involved during the past forty years.

It is certainly not my intention to justify or to gloss over the terrible crimes that have been committed. Guilt must be recognized as such. But at present it sometimes seems as if the piles of records in the Normannenstraße, with all the

evidence of wrongdoing, were being put on the same level with the piles of corpses in Auschwitz. Yet the difference between the two is something that, out of respect for those who perished there, we should not attempt to blur. In political terms we are still very far from really coming to grips with all the questions that confront us arising from the history of German guilt in this century. A political tribunal could make a helpful contribu-

bution leading to acknowledgement of what really happened. I hope that a concrete form for the realization of this idea will be found. Here the Christian churches, in particular, would have an important mission to fulfil, if it is, indeed, in accordance with Christian belief that the profound relation between guilt and reconciliation should take precedence over that between guilt and sin.

English translation by Greeley Stahl

Overcoming the spiritual void of our time

The development of fundamentalist currents of thought

Martin Greiffenhagen, Esslingen

Fundamentalism was, in its origins, a religious phenomenon, and, in a sense, it still is, even in manifestations of a secular or political character. The following article is concerned with this question.

At the beginning of the twentieth century an evangelical religious revival took place in the Protestant churches of the United States. Against the predominantly scientific spirit of the times, the following immutable principles of the Christian faith were proclaimed with doctrinaire intransigence: the Bible as, in the most literal sense, the Word of God; the virgin birth; the divinity of Jesus Christ; his Resurrection and the Second Coming. The word "fundamentalist" was taken from a journal, "The Fundamentals: A Testimony to the Truth", which appeared between 1910 and 1915. And then, in 1925, came the so-called "monkey trial", as a result of which the fundamentalists were able to forbid the teaching of Darwin's theory of evolution in public schools, even if only for a short period of time.

In possession of established truths

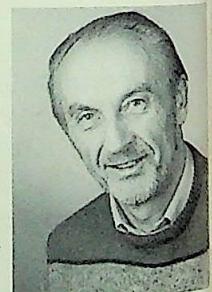
In keeping with the origin of the word, a fundamentalist is, therefore, someone in possession of established truths, to which he is determined to adhere. The strength of his convictions is in his faith; he will have

nothing to do with scientific doubts or worldly scepticism. This attitude he bases on an authority which, as the foundation of his belief, is inviolable. In the case of protestant fundamentalism, this authority, since the Reformation of Luther, has been the Word of God as it stands in the Bible. With this verbal fundamentalism Luther turned against the Catholic fundamentalism of

Professor Martin Greiffenhagen was born in 1928. Following an apprenticeship in the book trade, he studied at Heidelberg, Göttingen, Birmingham, and Oxford, his course of study including philosophy, literature, economics, and sociology. From 1962 to 1965 he was professor at the College of Education at Lüneburg, and from 1965 to 1990 director of the Institute of Political Science at the university of Stuttgart. Since retirement he has been a freelance writer.

Among his writings are: *Das Dilemma des Konservatismus*, 1971; *Ein schwieriges Vaterland*, 1979; *Von Potsdam nach Bonn*, 1986; *Propheten, Rebellen und Minister – Intellektuelle in der Politik*, 1986; *Das Glück – Realitäten eines Traums*, 1988.

*Professor Martin Greiffenhagen, Im Heppächer 13
7300 Esslingen/Germany*



papacy and the traditions of the church. But this verbal orthodoxy was directed not only against Catholicism but with equal force against a kind of Protestantism that derives its truths from an act of conversion and a personally illuminated preoccupation with the Scriptures resulting from this.

Fundamentalism in opposition to enlightenment and modernity?

These different varieties of religious fundamentalism, whether of Catholic clericalism, of Protestant belief in the Word of God as recorded in the Bible, or of rapturous personal illumination, are equally hostile to an attitude of mind which does not recognize these things as sources of truth and meaning, and which deprives them of their ultimate validity by "explaining" them, that is to say, by placing them in a larger context. The orientation for this new context is provided by human reason and the analytical spirit, searching for grounds within the world of man and ignoring everything that transcends the realm of human experience. In opposition to the Protestant fundamentalism of the Bible as the Word of God, there developed a school of Biblical criticism according to which the Bible is a book that owes its origin to human beings, with the consequence that its authors and the circumstances of its origin can be subjects of scholarly research just as in the case of any other book. For example, we know today that myths of virgin birth were widespread in the Near East. Similar parallels can be found in religious history for the conception of the Son of God. Biblical criticism was followed by a host of scientists who destroyed the Biblical picture of the world. Copernicus had been one of the first of these, and Darwin was not the last.

This intellectual movement, known as

the enlightenment, has led to the secular rationalism of modern cultural history. Fundamentalism is hostile to the enlightenment and hostile to the modern world. What the enlightenment and modernity have in common, something that makes of them one single movement, is the renunciation of self-evident truths. The principle of knowledge in modern philosophy is doubt, and, moreover, systematic doubt, according to Descartes, the pre-condition of all certain knowledge. It is only through doubt that thinking can acquire a secure basis. It was in this sense that Nietzsche spoke of philosophy as the school of mistrust. Today fallibilism is the only criterion of truth that critical rationalism is willing to accept, a never-ending process of constant criticism. Statements of which it is not possible to establish the falsity, in cases where they are false, cannot be considered knowledge.

In social and political revolutions, emancipation has played the same role as doubt in philosophy and in the sciences. New social groups demanded the abolition of barriers of rank and class, because these barriers were bound up with ideologies based on power and could not survive a critical sociology, psychology and politology of the human race. The coloured peoples claimed their human rights, and women revolted against the oppression that they had endured for thousands of years. Time-honoured ideas and conceptions supported by religion were also rejected together with social barriers. These ideas were condemned as prejudices. That which had once been considered holy lost its capacity to inspire, and was now designated as a "superstructure".

The self-conscious mind

Mobility is one of the key-words of the

modern epoch; it denotes one of the characteristic features of our time. Nothing remains what it was; everything changes, either moving to another location or disappearing altogether. This is equally true of social standing, manners and customs, authority and tradition, home and family.

But the more the world changed, the more ambivalent became the reactions to these modern developments. Though at first welcomed as a liberation from ancient superstitions, political control and intolerable social barriers, these developments, from the beginning, led to certain grievous consequences which, in the first intoxication of freedom and enthusiasm for progress in all domains, had not been perceived: uncertainty, anxiety, and loss of orientation. The firm foundations derived from both the natural and the social environment and previously regarded as immutable realities, gradually fell away, one by one. In the past, the familiar landscape, together with traditional institutions, had given the individual his orientation in life; but now the time had come to create new modes of thought, as the old ones had been destroyed by scientific doubt. Now that the principles of the natural and social order which had previously given meaning to life were no longer credible, the modern mind was confronted with the task of finding a new meaning in the world in all domains.

This new orientation developed from a principle that would henceforth guide modern thinking, that is to say, self-consciousness. Modern systematic thinking is the attempt to bring order into a world that in itself no longer holds together. The connection of the physical and social world must be brought to light through a new kind of methodical thinking in sustained analysis. This new thinking involves a radical

change in the meaning of the word theory. The modern mind now searches for the "condition of the possibility" of something, that is to say, it searches for a possible theory in the sense of a working hypothesis, analogous to what a physicist has in his experiments. From the analysis comes the technical achievement, at first in the experiment and then in the reconstruction of the whole environment in which modern man sees himself as its creator. It is the methodical procedure of the selfconscious mind that first makes the world a familiar once again. But this familiar world is no longer the old home of an essentially unchangeable environment; on the contrary, constantly changing, it is dependent on the modern spirit, which, inquiring, analytical and flexible, necessarily lives from progress. We can see, then, that if enlightenment frees us from anxiety, from the fear of mumbo-jumbo and unsuspected oppression, it can, at the same time, cause new anxiety, more precisely, fear of this self-made world, which confronts us with the question of its meaning. This question of meaning shows the dilemma of the modern spirit, and all criticism of the enlightenment is based on this. The further the march of progress and the more rapid the tempo of modernity, the more urgent, event among rationalists, does the question become whether rationalism has a meaning in itself, which, over and above its destructive analytical power and emancipatory function, can give mankind an orientation and sense of purpose. As long as the world is filled with injustice, suffering and tyranny, as long as human beings must endure starvation and torture, the rationalist can be satisfied with the meaning and purpose of a life directed against such inhuman cruelty. But what would his predicament be in a world in which his objectives had been achieved?

The critique of modernity

In the present article I shall later return to this question, so essential in the origin of fundamentalism. Here I should like to consider the dialectic of enlightenment, as it is set forth in the theory of two authors, who, under this title, have produced a critique of modernity so far-reaching that anything of the kind more fundamental than this is inconceivable. I refer to the book, "Dialectic of Enlightenment" by Theodor Adorno and Max Horkheimer. And when I speak of a fundamental critique I use the term advisedly, for this critique can itself well be considered a form of fundamentalism.

According to Adorno and Horkheimer, the purpose of rationalist enlightenment has always been to free mankind of fear. Their book begins with the following words, which have now become classic: "In the most general sense of progressive thought, the enlightenment has always aimed at liberating men from fear and establishing their sovereignty. Yet the fully enlightened earth radiates disaster triumphant". Where does this disaster come from? From the same source which is the ground for fearlessness, the desire to dominate. "Power and knowledge are synonymous". The enlightenment, by depriving the world of its enchantment, has at the same time deprived it of meaning. "On the road to modern science, men renounce any claim to meaning. They substitute formula for concept, rule and probability for cause and motive". The distinction between a purposive rationality and a rationality of meaning is fundamental in the dialectic of the enlightenment. The unbridled determination of man to be sovereign over nature and over society has had the consequence that the sense of an original unity between man and nature, still present in pre-historic times, has been lost for the benefit of a system that only reflects man's will to domi-

nate. Enlightenment thus acquires a totalitarian dimension. Everything is subject to the determination to dominate; and anything that does not submit to this is levelled by mathematics and cybernetics, the law of excluded middle and a conception of universal sameness that has no place for mana, totem, animism or myth.

Bourgeois society is the last stage in this levelling process, affecting all powers that, at first, were felt to be different. "Bourgeois society is ruled by equivalence. It makes the dissimilar comparable by reducing it to abstract quantities. To the enlightenment, that which does not reduce to numbers, and ultimately to the one, becomes illusion; modern positivism writes it off as literature. Unity is the slogan from Parmenides to Russell. The destruction of gods and qualities alike is insisted upon".

Because the enlightenment openly attacks any belief in something outside ourselves and only recognizes that which as immanence can be an object of our thoughts and measurements, the human reason, thus reduced to purposive rationality, only encounters itself. But this causes anxiety, more precisely, fear of emptiness and of an existence which can only be described in tautological terms, inasmuch as meaning from without is no longer allowed entrance.

The solace of art

Faced with this harrowing scenario, Adorno and Horkheimer can still offer us one small solace, one residual island of meaning, and that is art, of which they write: "The work of art still has something in common with enchantment: it posits its own, self-enclosed area, which is withdrawn from the context of profane existence, and in which special laws apply. Just as in the ceremony the magician first of all

marked out the limits of the area where the sacred powers were to come into play, so every work of art describes its own circumference which closes it off from actuality... In the work of art that duplication still occurs by which the thing appeared as spiritual, as the expression of mana. This constitutes its aura. As an expression of totality art lays claim to the dignity of the absolute".

Do we, then, have here a way of escape from the fateful situation resulting from the enlightenment and the ever-increasing spiritual void of our time? Art can, at least, point to the lost meaning of life, even if the prospects of reclaiming this meaning for art are not very good.

Gottfried Benn, in this akin to Adorno and Horkheimer, also sought to find in art, a "world of expression" as he called it, a way of transcending senseless modernity and raising oneself up to a world of meaningful activity. His nihilism was bottomless. In 1934 he wrote to Ina Seidel as follows: "Both within and without, I live with my lips pressed together. Speaking honestly, as living beings we no longer have any connection with anything, whether in the past or in the future; within ourselves we stand alone, silent and trembling".

The recourse to art, considered as the only reservoir of meaning, can be traced back to the age of romanticism. It was in the romantic school that, for the first time, a critique of modernity was carried out on a large scale. At this time the romanticists, with feelings of despair, and faced with nihilism in theology and philosophy, in political science and technology, felt that only art had meaning. Everything was to be poeticized, so that it would have meaning as an aesthetic value; moreover, this applied both to nature and to love, both to the State and to the economy. It was believed that art could give that totality of mean-

ing which had been lost through the onrush of modern science and technology.

In our century Ernst Jünger has picked up this thread once again. In warlike conflict and struggle there is for him a psychological experience with aesthetic qualities. The following sentences might have been written by Novalis: "It is for art to show from large perspectives that life is to be understood as a totality. It is not something that has been detached, not something that has validity in itself; for there is no aspect of life that is not at the same time material for art".

"But man will be great"

Let us for a moment return to Gottfried Benn, for our discussion an interesting figure in that over a period of several months he believed that he had found meaningful totality in another form than that of art, that is to say, in the totalitarian state of National Socialism. This attitude cannot be simply dismissed as a mere aberration. At that time many people were subject to the temptation to look for totality in the dynamic politics of fascism rather than in a purely aesthetic attitude towards life nourished on a feeling of decadence. The totality which he had previously seen only in artistic production, Benn now saw in the realm of politics in the "great spirit of self-sacrifice and the submerging of the self in the totality, in the state and in the race". For a short time the Absolute appeared to be outside the individual and his meaningful reflection and to have a meaning already given. "Man desires to be great, and that is his greatness; his whole inner striving inevitably aims at the Absolute". In a radio broadcast, "The new state and the intellectuals", Benn closed with the following words: "Close the gates, build the state".

That is what fundamentalism is: apart from the apparently senseless progress of modern rationalism, the great quest for a resting-place in an Absolute that lies "beyond", that is to say, beyond the reflecting consciousness, beyond a rationality that recognizes as real only what the self has thought. The succession of these attempts still continues, and I will here mention only a few of them with a view to giving a systematic presentation of characteristic examples. The purpose is always the same: To find an anchor in an objective realm, in an Absolute, in a totality as against the ominous meaninglessness of a self-made reality, whose subjectivity causes so much suffering.

Religious Fundamentalism

Let us first consider the religious variety of fundamentalism. It is, one might say, the most radical form of fundamentalism in that it openly takes its stand on the side of belief and against the enlightenment and modernity. We have here the classical polarity between, on the one hand, autonomous knowledge and, on the other hand, the blessing of a belief that is not of this world and is based on an otherworldly domain whose source is to be found in God or a world of gods or spirits of one kind or another, or even in nature insofar as nature is understood in a pantheistic sense as a manifestation of spiritual powers. From the viewpoint of a transcendence that goes beyond our knowledge, we are concerned with essentially the same phenomenon in religion, in the church or in a sect. The believing Christian and the youth who believes that he has found salvation in an Indian pipe ceremony are both fundamentalists. It must nevertheless be said that Christianity and Judaism stand in a different relationship to the problems that

here concern us. Different in this respect from natural religions, Hinduism and other Asiatic religions, the fact is that Judaism and Christianity are themselves a source of modernity and of the enlightenment. This is a consequence of their conception of God. The God of the Jews and the Christians is not a part of nature, but a Being that has created nature out of nothing, that is to say, out of His own will. The consequence is that, once the belief in Him as the originator and preserver of the world is destroyed, the human mind, confronted with the question of the principle, that is to say, of the beginning of all existence, is necessarily driven to investigate ultimate causes. And so we find, time and again, in the history of Judaism and Christianity new movements of enlightenment that are very closely bound up with the fate of the modern world and its nihilism. Modern Protestantism has long since assimilated the contradictions of modernity, reflecting them with an awareness that it is itself a product of these contradictions. Its fundamentalism is thereby destroyed.

Fundamentalism as a critique of science

There is a second group of fundamentalist movements, collectively known as the New Age, which is associated with the books of Fritjof Capra. The critique of science plays an essential role in these movements. Here, however, there is no question of professing established religions or of putting together an eclectic amalgam from elements of these religions; on the contrary, according to the belief of its followers, the writings of the New Age provide direct, immediate revelation of holistic myths and rules of life, cosmic illuminations and interpretations of nature. The New Age claims to have gone far be-

yond scientific knowledge and to have surpassed and superseded it by means of its "holism". According to this school of thought, life in all its different aspects, should once again be united in one complete whole, as, for example, nourishment with sociability, politics with sowing and harvesting. This holistic view of the world is not an entirely new development; it was already adumbrated by a number of movements in the period between the two world wars: the anthroposophy of Rudolf Steiner, the philosophies of Monte Varità at Ascona, and many other vitalist movements, which, including such very different things as the eating of uncooked food, dance as a source of liberation, air-bathing and meditation, omitted nothing that promised to contribute to a feeling of life as one integrated whole. Different in this respect from the great religions based on revelation, these movements seem, at first sight, to be on the side of modernity. They show all the characteristics of the adversary to whom they are opposed. And there are times when some of them even carry on their arguments in a genuinely scientific manner, when it suits their convenience to do so.

Political Fundamentalism

A third group consists of political fundamentalists. The Green party, convinced that the earth is faced with an imminent ecological catastrophe and despairing of preventing this within the framework of the present political system, calls for an altogether new and fundamental reorientation. The consequence is that the fundamentalist school of thought of the Greens and other alternative parties leads to tension and conflict with liberal democracy with its pluralist principles and belief in majority rule. If the danger is fundamental, then, according to them, it is frivolous, not

to use a stronger expression, to take a vote on the question before deciding if something should be done about it. Dangers of fundamental nature call for fundamental means of prevention. At the very least such refusal to compromise leads to civil disobedience, a kind of opposition which however, is tolerated within certain limits. This attitude means conflict with a whole society, or, at least, its majority; it is a conflict initiated by people who, believing that they alone are in possession of the truth, are determined to do everything possible to make their viewpoint prevail throughout the whole ecological environment against a scientific and political culture which, in their view, can no longer perceive the dangerously narrow horizon of its thinking.

It is its criticism of a kind of modernity whose knowledge, technical and other, is clearly not sufficient to do away with the most serious dangers for the future of mankind, political fundamentalism makes use of an argument that also has significant weight in the fundamentalism of Islam. The kind of modernity with which we are here concerned was originally a European phenomenon, which has since become the common property of all the developed industrial nations. However, the countries of the Third World see only the negative aspects of modernity, which are colonialism, exploitation and increasing misery. The same thing can also be said of the foreign workers from these countries, who in our modern world just manage to eke out a precarious existence. It is not surprising that the hostile fundamentalist reaction should have been particularly sharp in Iran where, under the authoritarian, autocratic regime of the Shah, a policy of modernization was attempted, which, however, brought nothing to the broad masses of the people, and should have spread to other

countries in a similar situation. Nor is it surprising that fundamentalist attitudes should appeal strongly to foreign workers. From the insight that modern technology has been only a very limited phenomenon of western civilization, and moreover, something which has been more harmful than beneficial to the world as a whole, the Greens and alternative parties draw the conclusion that a fundamental, radical change of direction is called for. Their policy is based on an understanding of nature and society which would again permit the powers of self-control and self-healing to function. They, therefore, stand for homeopathy instead of allopathy, natural instead of harmful chemical fertilization, and the natural resources of sun and water instead of fossil fuel or, still worse, nuclear fission. These examples bring out the fundamentalist viewpoint in a very palpable way. Natural resources are the basis of our life and, therefore, whoever contaminates water, the air and the earth commits an offence against mankind.

The deficits of enlightenment

All the fundamentalists from Adorno and Horkheimer to the Greens are very active in calling attention to the deficits of the enlightenment. And there can be no doubt that enlightenment and modernity are imperfect. It has its ambivalences, perhaps even a fatal dialectic. German history, both intellectual and political, is remarkable for a singularly incisive and radical critique of the enlightenment. This is to be explained by the fact that, in the course of German history, the different aspects of modernization were not properly integrated with one another; that the different strands of modernity, including industrialization, democratization and cultural emancipation, progressed independently, some-

times even turning against one another, and thereby, time and again, leading to radical attempts to escape from this onward process of modernization.

I submit that, instead of turning one's back on the modern world with grim determination, the proper course would be to take measures to improve it. This will only be possible by following where the enlightenment led the way. What we need is not a curtailed but an enlarged enlightenment, not a modernity that has come to a standstill at the half-way mark, but one that, recognizing its deficits, puts an end to them. The same thing could be said of progress, a notion that is so disparaged today. In order to do away with the havoc that has been caused by an unduly naive belief in progress, especially technical progress, what is needed in scientific research is not a halt or a regression but further progress.

In expectation of a century of ennui

This appraisal of the situation excludes all expectations of a posthistorical lull, of so-called "posthistoire", a post-modern epoch as, for example, conceived by Francis Fukuyama, an unhistorical condition of standing still in present conditions. Fukuyama now anticipates a century of ennui. He believes that a post-historical consciousness will lead to something like the end of history. According to this vision, the ideologies will have lost their followers; societies based on liberal principles will be established throughout the world; religion and nationalism will no longer give rise to fundamentalist movements. From this perspective, liberalism itself is conceived as a consequence of the frailty of societies based on religion; and, from the same perspective, it is believed that, in the long run, even Islam will not be able to shut itself off

from a view of the world based on liberal scepticism. As Fukuyama sees it, this prospect is no ground for optimism. On the contrary, he writes as follows: "The end of history will be a very dismal time. The battle for recognition, the willingness to dedicate one's life to an abstract objective, the world-wide ideological struggle, which in the past has inspired a spirit of adventure together with bravery, imagination and idealism, will be replaced by scientific calculation, the never-ending concern with problems of technique and of the environment together with the satisfaction of the very particular wishes of a consumer society. In the post-historical epoch there will be neither art nor philosophy; there will only be further sustained preoccupation with the past history of humanity. Perhaps it is this very prospect of future centuries of ennui, following the end of history, that will again set the course of history in motion."

Short-sighted egoism

I cannot agree with this viewpoint, nor do I see any indications that would justify it. On the contrary, modern developments will continue, and the contradictions attendant on these developments may even be exacerbated. Ulrich Beck deals with this question in his book, "Risikogesellschaft. Auf dem Weg in eine andere Moderne", (A risk-taking society. Towards another kind of modernity). It is his thesis that the progress of the modern world, whose chief aim has hitherto been to achieve the maximum of profit and wealth with scant regard for other considerations, has led to strategies in science, technology, economics and politics, which, in all domains, endanger the very things that this progress has brought us, that is to say, high technical standards, a high gross national product,

social security and control over nature. These contradictions are the central concern of Ulrich Beck's book. He points out that dangers for all mankind increase in proportion as everyone considers only his own personal advantage, dangers for business, for nations and future generations, and likewise for the individual. This egoism is short-sighted inasmuch as the disasters for which it is responsible, will one day fall back on us as the result of a chain of unintended secondary consequences.

However, in contradistinction to the fundamentalists, Ulrich Beck sees the solution to this awesome problem not in flight from modern rationality but rather in its better use. This, of course, would involve a re-examination and revision of scientific principles, political beliefs and economic maxims; yet such reappraisal would not mean a rejection of the modern world and its foundations; it would not mean a turn to transcendental dogma and practices.

An awareness of the deleterious consequences of modernity does not necessitate turning away from its political foundations. Anyone who, refusing to bury his head in the sand, desires to continue in the tradition of the enlightenment with all that this entails is still dependent on the political culture with which it is so indissolubly bound up, that is to say, pluralist democracy. Without tolerance there can be no enlightenment. When open-mindedness disappears, that is the end of enlightenment and modernity; the surrender to fundamentalism has taken its place. Is this equally true of the majority principle? What is to be said of the validity of certain universals as preconditions of humanity?

With these questions we come, by way of conclusion, to the political core of the problem of fundamentalism. Do enlightenment, modernity and pluralist democracy

owe their existence to religious and philosophical principles which they themselves cannot establish? In the first sentence of our constitution, in which the dignity of man is affirmed without further explanation, we have the expression of a fundamental principle of human civilization, as we understand this; this is not the expression of a political fundamentalism for which different parties and states combat one another in order to subjugate and convert people of a different faith.

As an example of this tension between the basis of a humanity that is unquestioned and politically presupposed, on the one hand, and, on the other hand, the fundamentalism of a policy that leads to totalitarianism, I quote a passage from the novel, "The Handmaid's Tale", by the Canadian novelist, Margaret Atwood, which appeared in 1985. In this novel a woman attempts to break away from a totalitarian regime, and, in this attempt, has the help of people bound by religion, who risk their own lives in order to conceal her from her persecutors and to make possible her further flight. She thereby escapes from one kind of fundamentalism only to fall into another. Even the organization of the meetings of the two fundamentalisms shows an unmistakable similarity.

"One of the hardest things was knowing that these other people were risking their

lives for you when they didn't have to. But they said they were doing it for religious reasons and I shouldn't take it personally. That helped some. They had silent prayers every evening. I found that hard to get used to at first, because it reminded me too much of that shit at the Centre. It made me feel sick to my stomach, to tell you the truth. I had to make an effort, tell myself that this was a whole other thing. I hated it at first. But I figure it was what kept them going. They knew more or less what would happen to them if they got caught."

Where does the difference lie between the fundamentalism of the Christians and that of the totalitarian politicians? The difference is that the fundamentalism of the Christians is a fundamentalism without coercion, based on concern for the individual, and, in the political sphere, proves its value in cases of suffering and affliction. Political fundamentalism, on the other hand, aims to establish a system of totalitarian rule to which everyone must submit; a system of political coercion which has no respect for any personal convictions and standards of value which are outside the political realm. But it is the fundamental principle of our liberal constitution that the state should respect the right of each individual to preserve his personal identity.

English translation by Greeley Stahl

Love as Identity?

Female biographies in upheaval

Elisabeth Beck-Gernsheim, Munich

"A ship will come, which will bring me one, whom I'll love like none other ...". In the text of pop songs we hear of the eternal love. Polls show that life as a couple is seen as the land of hope, as the place where intimacy, warmth and tenderness are to be found, in contrast to the cold wastes of concrete outside. But at the same time in recent years the dream of the fairytale prince and of happiness for ever after has developed deep cracks. On the screen and on the stage, in novels and in personal reports, wherever you look you see the turmoil of battle. The business of the marriage guidance counselor is thriving, the family courts are busy, the divorce figures are high.

It cannot be overlooked that the relationship between man and woman has fundamentally changed in the course of this century. A new sharing has certainly arisen – but also new tension, conflicts and disputes. Many, from feminists to their most obstinate opponents, see women as the driving force in this development. What is different is how these changes are seen; either the woman is the victim who has finally started to defend herself, or she is the guilty party who is disturbing the old order.

Let us look more closely at this much discussed, controversial and highly emotional theme, the role of the woman in the changes in the relationship between

the sexes. To clarify the roots of this development I will start with a look back in history. This should show us how the transition from premodern to modern society has palpably changed the contours of everyday life and has redefined the relationship between man and woman.

Love and Identity: the Historical Roots

Comparisons between premodern and modern society always emphasize the

Professor Elisabeth Beck-Gernsheim studied sociology, psychology and philosophy. At the moment holder of the Heisenberg Scholarship and Assistant Professor for Social Psychology at the University of Munich.

Research and teaching emphasizes: job research, family research, research on women, research on the results of technology, such as in reproduction and genetic engineering. Most recent book published: *The Totally Normal Chaos of Love*, 1990 (with Ulrich Beck).

Prof. Dr. Elisabeth Beck-Gernsheim, Institut für Psychologie, Ludwig-Maximilian-Universität München, Geschwister-Scholl-Platz 1, 8000 München 22/Germany



life used to be defined by a multitude of traditional bonds — from the family and village communities, home country and religion to social status and sex. Such bonds always have two aspects. On the one hand they severely restrict the possible choices of the individual. On the other hand they offer familiarity, protection and a basis for stability and internal identity. Where they pertain one is never alone, but cared for as part of a whole.

This begins to look different during the transition to a modern society. There are then developments at many levels which introduce extensive "individualization", release of man from traditional bonds, creeds and social relationships. For the individual this brings release from old controls and constraints. On the other hand the conditions which gave premodern man support and security are annulled. The demands of the job market, social and geographical mobility, pressure to consume and the mass media, all serve to grind down, either directly or indirectly, in repeated thrusts in ever growing strength, many of the traditional bonds and social relationship which bind the individual to his surroundings, his origins and his history. In the course of increasing secularization, pluralization of ways of life and competition between values and creeds, many relationships are dissolved which present a view of the world, which give life a meaning and which anchor the individual existence in a larger cosmos. The gain in freedom to act has its price: "Modern man (in Europe) has been damned to freedom. He has no shelter."¹ A state of "internal homelessness" is becoming more common.

Love and Marriage as Anchor of the Internal Identity

Transition to a modern society brings

with it a fundamental change in marriage and family. What was once a working and economic union is taking on more and more the character of an emotional union. The development of the middle-class family brings "a sentimental replenishment of the intrafamilial space"³, to the crystallization of the privateness and intimacy which characterize our modern picture of the family. It is presumably not a matter of chance that this happens in an epoch when traditional bonds are becoming fragile. The internal space in the family is clearly taking on a balancing function. It provides a substitute for the significance and social relationship which are being dissolved during the transition to the modern age. It is this increasing isolation and meaninglessness which encourage this desire for family: the family as home, to make the "internal homelessness" tolerable, as a "harbour" in a strange and unfriendly world.

The core of this development is a new understanding of love. It is the example of a both romantic and durable love, which grows from the close emotional bond between two human beings and which gives their lives content and sense. The basic idea can be described as follows: The more other stabilizing factors fall away, the more we direct our need to give our life sense and content towards the pair relationship. More and more now we direct our hope towards another human being, a man or a woman. He or she is supposed to guarantee us stability in a world which is spinning ever more rapidly.

With this background the modern marriage wins a new significance, just that with which we are familiar. Personal identity is becoming more and more a basic theme of marriage. In exchange with the partner in marriage we are also looking

for ourselves⁵. We are looking for our biographies, we want to reconcile ourselves to our disappointments and wounds, we want to plan our hopes and aims in life. We reflect ourselves in the other and the picture of You is essentially an idealization of Me: "You are a picture of my secret life"⁶, my "better Me". Love and identity are being directly interwoven.

Love as Identity: the Special Role of the Woman

The above discussion was intended to show the historical roots of the connection between love and identity. The viewpoint has been neuter, with no distinction between man and woman. On the other hand more recent historical research has shown that the transition between pre-modern and modern societies has proceeded separately for the two sexes. This difference in development and experience is central to the following sections, particularly to the question of why love has particular significance in the biography of a woman, has in fact the dominant role.

Polarization of the Roles of the Sexes

The family lost its role as working and economic community with industrialization in the 18th and 19th centuries. The biographical consequences for man and for woman are quite different. More and more frequently the man works outside the home. In keeping with the new role model of the rising middle-class the woman is allotted the inside of the house. Thus she no longer prepares the goods needed each day, but buys and consumes prefabricated objects. However her responsibility is simultaneously widened to include emotional assignments, which in more recent work is described as "emotional" or "relationship work".

There is thus a new division of responsibility between man and woman. He is responsible for the external world, profession and the public; she for home, household and family. Not only do the immediate fields of activity become more different, but also how "male" and "female" features are seen. Clear polarization occurs of the roles which society expects the sexes to play. There is a dominant idea that in the plan for the world there is complementarity between male and female "characters". The man is characterized by activity, self-assertion, strength and intelligence; the woman by docility, modesty, emotion and feeling. In the resulting new role model the woman is regarded solely in relationship to the man: she is defined and restricted by his interests, is seen as his personal helpmeet. "To please him" is her first commandment and inseparably connected to this "to serve him".

These principles are particularly clearly formulated by Rousseau in "Emile", an essay on education which has become a classic. The advice there to Sophie is: "Become such a real part of him that he can do without you any more and that he feels far from himself the moment he leaves you (...). Remember that you will become a happy woman when your husband is happy at home". And elsewhere: "The woman is not created for her own sake but "to please him and to put herself at his disposal", "to make herself pleasant to her husband", "to give in to her husband and even to tolerate his unfairness".

When the roles of the sexes are seen in this polarized way the woman is said no longer to be a person with her own rights and demands. Invisibility and humility are the embodiments of female virtue. The woman should not achieve by active effort but remain passive and forget about

recognition and reputation. In the (ideal) male view of the woman her ego is extinguished; she only exists as a reflection of male dreams.

"Oh woman, you are not what you are!
You are what we dream of you!
You are what shines through the darkness
into our enthusiastic view!
Oh woman, let us sing, say, complain –
You are what you perceive of us".
(Peter Altenberg, born 1859)

The Principle of the "Halved Modern Age"

A striking discrepancy can be established here. On the one hand the modern age started with the project of the Renaissance, which aimed at liberation from wardship and promised universal equality and justice. In practice this programme was not realized at all but totally restricted to man, as though this were a matter of course. If one regards the underlying historical and social conditions one can infer that this restriction, "this halved modern age", can be definitely useful in practice. The new roles of the sexes do not arise by chance but are a fundamental part of the newly developing industrial society. The early phase of bourgeois society is the period when the economy is released from feudal and guild restrictions, but has not yet been subjected to the restrictions and protective laws of the social state. In the struggle between competitors the rules for survival are often correspondingly hard. The role of the woman is designed to some extent as a contrast and antipole to the homo economicus of the market. The connection is then not one of chance. The more the man must go out into the hostile external environment the more it is the job of the woman to make life beau-

tiful, to heal and to complete what has been wounded by brute force, to reconcile existence to itself (Henriette Feuerbach 1839). The woman is thus the vision of a better world, of a lost paradise.

"The sweet world of the woman" should be a "happy and quiet oasis", "a source of poetry for life, a residue of paradise. We do not want this to be taken from us by "the question of women's rights", by unhappy blue-stockings or by overeducated economists. With God's help we wish to keep them to as great an extent as possible away from the poor and poorest "worker". (Nathusius 1871)

The consistently occurring inequality of the sexes is from this viewpoint no historical "accident", no small deviation from the path into modern times. On the contrary, this inequality has a foundation. The assigned role of the woman as "angel of the house" (Virginia Woolf) serves the spiritual health of the man. He is the "modern man without shelter" who is looking for a refuge.

The Price for the Woman and for the Man

This connection between love and identity has become an imperative of middle-class life, but also demands its price, namely that the woman should abdicate her own identity, her own independent possibilities in life. This can be clearly seen in education. In spite of the expansion of the public educational system there were hardly educational opportunities for girls up to about the end of the 19th century. Working class girls received rudimentary instruction in reading, writing and arithmetic, and often not even this. Upper middle-class girls were taught the rules of etiquette, music, French, handicrafts and socially acceptable conversa-

tion. Every hint of independent interest was damaging to the marriage prospects and therefore excited suspicion. Education for girls stopped where independent understanding of a subject began.

"Every woman really learns only from the man whom she loves and she learns exactly what and how much the loved and loving man gives himself the pleasure of teaching her. What happens in real life is that girls marry and are then educated in marriage. Equally sisters, daughters and nurses can be made into something by brothers, fathers, invalids or old men, when the women serve the men with a warm heart". (Programme for the Conservative Party of Prussia, drawn up by Paul de Lagarde 1884)

After the end of school the older daughters had to start waiting for the husband. As there were no socially recognized ways of living apart from marriage and motherhood every effort was directed towards marriage. There came the hunt for the husband, for the "good match".

"A good match — that was the aim of all the friends of my youth. For a good match they would tie their bodies tight, wash themselves, sing and dance when they felt half dead. For a good match they would lie or play the hypocrite (...). They were trained for a good match like a young pointer for the hunt. And they were on the hunt from the moment they exchanged children's dresses for dresses with trains." (From the reminiscences of the authoress Clara Müller-Jahnke, born 1860.)

And when the safe harbour of marriage had been reached? Then many middle-class women felt what sociologists call the "loss of function in the family", which researchers on the role of women characterize as the "great domestic emptiness".

This was because the family economic unit of the old type, which had satisfied most of the daily needs from its own production, shrank during the 19th century more and more to a private household which bought wares in the market. In the course of this development many tasks were given up which had earlier been part of everyday life for the woman and which, although burdensome, had given meaning to life. What remained was inadequate for more and more women. They experienced the meaninglessness of their form of existence — "the moth hole of domesticity" (Bettina von Arnim) or "cotton wool of everyday life" (Virginia Woolf).

Majority scientific opinion admitted showed little interest in such "problems of women" for a long time. On the contrary, prominent authors in the 19th century right into the 20th century transfigured this polarization of the sexes into a achievement of civilization or to a functional necessity. Interestingly it was first in novels and dramas (more written by women than by men) that attention was drawn to where questions were seething to the surface, to where desperation was building up behind the middle-class facade.

"He is a man and I am a woman. His life is fulfilled and mine is empty, in so far as he does not fulfill it" (Vita Sackville-West)⁸.

"We men, we produce and research at work, we have office and profession at our little pleasures and our little vices but what do women have, who can only live in love and hope in love?" (Hermann Hesse)⁹.

In the meantime more recent research has repeatedly examined and described this role division of the sexes. In particular this research has brought to attention

how this causes women to suffer limitations, injuries, even deformations, while men are in many ways the beneficiaries. Admittedly it then becomes evident that women are not only the passive victims in the scenario of the division. Women develop their own aims and plans, strategies of self-assertion and defence. These have been described as the "cunning of the weak"¹⁰ and the "vengeance of the victim".¹¹ Flattery and caresses bait him and entice him, bind him and chain him. The "strength of female weakness"¹² is used against the man. When there is no alternative, no other way of earning a living, then the man must become an object, to be exploited in the interests of the woman. In the context of the polarization of the sexes love often becomes ware for barter.

"When there are dramatic inequalities between men and women and when women occupy a clearly subordinate and disadvantaged social position, then they inevitably become psychologically unequal too. Then men and women are incapable of understanding each other and of regarding each other as human beings. Instead they use each other more as objects and try to become the winner in the game which is sometimes known as the 'battle of the sexes', in which sexuality is exchanged for commitment and security."¹³

The "halved life" — the male world of work and the female world of family — creates this clear separation in everyday life, each with its own purposes and aims, conflicts and crises, ambitions and fears. The result may not be communion and understanding, but the converse, namely misunderstanding, distance and alienation. You live next to each other and past each other.

"She let Miles sit at her feet and, while

her hand rested on his hair, she planned how she could keep him overnight in London. She knew that he had his book to write; she knew that he worked hard; but she could not see that twenty-four hours should make so much difference (...). Then he stayed of course. But he loved her less afterwards. He valued planning his life according to a timetable: a time for reading and a time for love. Evelyn disturbed this system; for her all times were there for love (...). Love and a woman were not enough for the active mind. Love and a man were however more than enough for a hungry heart and an unoccupied spirit" (Vita Sackville-West).¹⁴

Women on the Search for New Life Models

There have been rapid changes since the start of the modern age and the rise of the middle-class family. The release from traditional relationship was first restricted to men, but also became perceptible to women, initially towards the end of the 19th century but then very markedly since the 1960s. For example in education:

"The extension of education has produced particularly profound changes in the area of higher education for girls. In 1921 only 0.7 per cent of the young people between 16 and 19 receiving higher education in Germany were girls. In 1956 the corresponding percentage in the FRG was 3.8, in 1975 16.2. In 1955 only 0.8 per cent of girls in this age group were studying, in 1975 5.9 per cent."¹⁵

Here we see a developing tendency which signifies an historical upheaval in the biography of the typical woman. According to the middle-class model of the 19th century it was the fate of young women to wait, in the hope that the

"right one" would come along and lead her into marriage. In contrast, today young girls and women are trained for the "self-written biography" which the individualized society demands. The classical question of the 19th century was: Is she pretty enough, gentle enough, modest enough, to please a man? Towards the end of the 20th century there is an additional and possibly more important question: Will she manage to achieve an advantage in the competitive educational system? Can she collect enough points in the fight for trainee positions or a university place?

Similar developments are evident in other areas. A basic pattern becomes clear. As a result of changes in education, profession, family cycle, the legal system etc., more and more women are at least partially freed from their familial bonds. They can expect less and less support from their husbands and are forced, albeit often in an inconsistent manner, to be independent and to support themselves. The subjective side of these changes is that women today increasingly develop or must develop expectations, wishes and plans for life which are no longer exclusively related to their families, but to their own persons. They must learn to plan their own existences, at least economically in the first place, without the help of men. They can no longer see themselves as an appendage of the family but must see themselves increasingly as individuals with their own interests, rights, plans and possibilities. What is even more important is that more and more women are collecting their own experiences of what life is like outside the family, of what chances are offered and of what the disadvantages are. For the first time there is a real choice for many women: life without family, husband or child. For the

first time there is a competitive model, no longer that of the mother of the family, but that of the independent and free woman. The typicality of normal female biography, with its stages and aims, is replaced by a new variety. While traditional milieus and forms of life continue to exist groups with other orientations and resolutions grow up. Here personal expectations and experience become a part of the "social character" of the women, a part of her personality. They become an internal criterion by which she measures much else — such as the relationship to the husband and the existence for the family.

The Stake to a Claim on "One's Own Life"

In the sixties many people began to distance themselves from the traditional roles and to look for new forms of life. At first this search was limited to small groups but later influenced wider and wider circles. Let us now look at some important milestones in this development.

Firstly, when Betty Friedan's book "The Feminine Mystique" appeared in 1963 it attained enormous sales and was one instigator of the new feminist movement. This effect can presumably be explained on the basis that it reveals a problem which numerous women had secretly felt but had never dared to discuss. It is the problem of a generation of women caught in the no-man's land between old and new expectations. The pattern of the traditional biography is already too restrictive for them, but other and broader possibilities are hardly available. They are mostly middle-class women of good education who have worked for some years in a more or less well qualified pos-

tion and who in this time have built up many habits and expectations of an independent life. They have then found themselves in the posh suburbs, bound to an existence with man and child, house and home. As Friedan describes it, many of these women have the feeling that they are losing themselves, that a part of their personal internal life is dissolving. What remains is a diffuse feeling of emptiness — “the problem without a name”, as Friedan calls it. This is evident in interviews:

“I feel somehow empty ... incomplete ... I have the feeling that I don’t exist at all.”

“The problem is that I am always either the mummy of the children or the wife of the vicar, but never myself.”

“I’m the one who makes the food, who puts on the trousers who makes the beds, the one you call when you need something. But who am I?”¹⁶

The inflammatory question, “Who am I?”, reveals the claim of a growing number of women to a right to their own possibilities and challenges in life. According to Friedan the only possible answer must be that women should develop their own, independent plan for life. In particular, marriage is evaluated differently and no longer regarded as the highest and single aim in life. It is more the case that women should develop their own abilities and use them in society: “The only way to find oneself as a person is through one’s own creative work, and this is as true for women as for men.”¹⁷

It is obvious that Friedan’s introduction of a “new plan for life” is designed for middle-class women. Nevertheless the argument which extends through her book has wider implications. It is the claim which is made, which must be made, when the process of individualization influences the typical female biogra-

phy. Women are no longer prepared to exist as an appendage for others. They want to be someone themselves, to do something themselves.

“To find yourself as a person.” This is the goal which was adopted by the new feminist movement, arising in the mid-sixties. There can be no doubt that this is basically a movement of educated middle-class women. However the resultant impulses extend, in many forms and with some distortions, into the motley world of advertising, into film and television, into books and newspapers. The ambitious demands are thus popularized and either given new content or tamed and adapted. It is now a question not of “self-realization” or “emancipation” but of a little more freedom and independence in everyday life. Such expectations appear everywhere, in both normal discussions and in scientific polls, with so-called career women and with the “average” housewife in the suburbs. In accordance with their own origin and class more and more women articulate the expectation of the individualization process: the claim to a piece of “one’s own life”.

Revolt against Love as Identity

It now cannot be overlooked that much explosive material is collecting in the relationship between man and woman. To some extent this is objectively predetermined. On the one hand more and more women work and are subjected to the job market. On the other hand comparatively little has changed privately. Although many men support equal rights „in principle”, in practice it is still the women who do most of the work in the house and in bringing up the children. The world of emotion is still regarded as especially for women. In other words, the wife is subjected to the pressures of individualiza-

tion (competition, limited time, hectic, planning) during the course of the day and in the evening is supposed to give her husband the other world, to be a paragon of patience and relaxation. Many women are demoralized by all these demands. They must live with the burden of this double role, make compromises at work, and have little free time and relaxation. Understandably this incites many an envious comparison with the husband: Why are the privileges and duties so unequally distributed?

As is well known, the disadvantageous position of women is no modern invention. On the contrary, in earlier centuries women were under the control and domination of men to a much greater extent. Nevertheless the present hierarchy of the sexes is of increasing explosiveness and social dynamism. Firstly, the inequality today is not legitimized to the same extent as before as a clearly defined component of the religious world order, but is in contrast to the new ideal, as summarized in the principle: "Men and women have equal rights." Moreover changes in the demands in bringing up children and in education also have their effect. Women of the younger generation have been raised to more independence and self-assertion and are more conscious of their own interests and more ready to defend them.

The tensions between the sexes thus become more acute. Conflicts become more open and can even be analysed empirically. Thus polls show that women tend to be less satisfied with their marriages than are men and to think of divorce more frequently. Statistics also show that it is mostly women who initiate divorce proceedings. These are all indications that women are less and less prepared to accept the form of life practi-

sed by previous generations — adaptation to the husband, with abandonment of their own rights and wishes. Now more and more women want to receive what they were previously supposed largely to give: feeling, tenderness and warmth. Now more and more women have had enough of being the agent of harmony and peace in the family. Look at the expanding market in women's literature, in many variations, in novels and in biographies, with irony, bitterness or desperation, it is formulated what "Love", as central theme of life, demands from women, how it encloses, lames, wounds and tames them.

"Not that I knew what it is (love). Once it has me tight. It holds and beats me, drives me, in its absence it attacks and conquers large parts of me. It is responsible that I live and do not die, that I live and do not live. It carefully makes sure that I stay as its appendage. It does not yield. It is simultaneously in all body and non-body parts. It keeps me occupied, spreads itself, hindered by nothing, greedily over me. My love. It sucked me up for an instant. Murderish would be an understatement. It was a cannibal. The brain was the tastiest part."¹⁸

In the recent bestsellers of women's literature rejection of love is announced as part of a programme — or more accurately rejection of the sort of love which continuously devours the woman. First came "I am myself" („Ich bin ich“)¹⁹, then "When women love too much" („Wenn Frauen zu sehr lieben“)²⁰ and then "When love has no future" („Wenn Liebe keine Zukunft hat“)²¹. And what about the one hope that there used to be? "With the next man it will be quite different" („Beim nächsten Mann wird alles anders“)²². Even this has been revealed as a delusion in millions of copies.

Freedom too has its Price

It must be admitted that the upheaval in forms of life has brought women not only new chances, but also new problems. Firstly there is the problem that can be called „the poverty of the single woman”. With this is meant women of poor education, poor working conditions and poor wages. Such women are only one husband away from the necessity for social assistance — and if he is missing, as with the growing group of single and divorced women, then the result is the “feminization of poverty”, as described in many studies. At the other end of the social scale is another problem, which is just coming to be recognized. It concerns those women with an independent successful career who often have a high price to pay in private life: “The loneliness of the successful professional women.”

Developments of this type have been described, for example, by the psychologist Jean Baker Miller. Her experience is that the problems which bring women to therapy have strikingly changed within a few years. In the early seventies most of the women who came were middle-aged, had married young, brought up their children and then finally recognized what possibilities they had given up. Today however those who seek therapeutic help are often professionally successful and industrious women of the younger generation, single or divorced, in whose lives the need for personal relationships remains unfulfilled. For hardly any man is prepared to act as houseman for such a woman and to care for and maintain her neglected emotional life. The consequences are predictable, as Jean Baker Miller writes: “Either both partners are totally occupied to devoting themselves to traditional ideas of success, so that neither has the energy to work on the relationship.

Or the career woman establishes that she has no partner at all.”²³

“Freedom of Choice” – the Offer of Competitive Models for Life

Many books euphorically and proudly announce the results. Women have finally been freed from men. Other books describe the situation predominantly gloomily and opine that women remain the permanent victims of history. Both these pictures fail to include an important part of reality. It is namely a characteristic of the present time that the forms of life for a woman are pluralized and that this brings both new chances and new insecurity. Instead of the unitary model an offer of competitive models arises and these differ according to the group and segment of the population, the ruling party and the state of the economy, and of course on the age and familial status. In particular three models have evolved:

The first model accepts the forces and developmental tendencies of the individualized society. This is called “equalization with the man”. According to this a woman should receive the same chances and be subjected to the same risks of the industrial society as are men. This is admittedly only possible if women internally shed everything that belongs to “the existence for others”. They have to learn how to assert themselves, with ambition and force, so that the best (wo)man wins in the general competition.

But no society can only function on the principle of “each for himself” or “each against all”. For no society consists only of physically and psychologically healthy thirty year olds. Everywhere there are people whose ability to achieve is restricted and who even require the care of others — children and the old and sick.

These are the weak points in the individualized society. Thus you still need someone who will fill the gaps of the "existence for others". This can, at least partially, be carried out by professionals. But that costs money and the national treasures are empty. The obvious solution is then to employ an old and proven tradition, i. e. the woman. Thus it is not an anachronism, but much more an inherent property of the system, i. e. the limits of the individualized society, that towards the end of the 20th century there are still many and repeated expectations, admonitions and instructions which emphasize the special "character of the woman". She is to practise "the gentle power of the family", as an oasis and niche in a world which only respects economic rationality.

Finally, there has arisen in the feminist movement the concept of the "new woman". She will not let herself be restricted to the traditional frame defined by kitchen and child. But she also does not wish to adapt like a greyhound to the compulsions of competition and career, in the far too serious games of power in the hierarchy. No: she wants more, a way which leads away from the false alternatives.

The question is only: What does that mean in practice? There is not yet a biographical sketch which is worth mentioning, just the search for this. Thus each woman must find her own answers, based on her personal reality, on the eccentricities and individualities of her own family and profession, in negotiation with the surrounding world and with her colleagues, with her husband and with other women, and last but not least with the many layers of her own personality, where so much is in upheaval and where the old lies hidden under the new. Thus a biography can be planned by personal

trial and error, away from clearly defined tracks. This can be liberating, but also threatening and burdensome; exciting but enervating; and in any case hard work. The question of personal identity will be brought up again and again. In many areas of everyday life, more or less openly, the question is raised: Who am I? Who can I be? Who do I want to be? What was once a clearly prewritten biography now has many stages and branches which keep on permitting and demanding new decisions. As Christa Wolf describes it: that women "manage now to reflect their own situation is a privilege which like every privilege has its price, that is abandonment of safety, security, giving up the earlier certainties of the dependent woman without the certainty of attaining a new identity".²⁴

English translation by R. A. Yerxa

¹ Weymann, A.: Scope for Action in the Biographies (Handlungsspielräume im Lebenslauf.) In: A. Weymann (ed.): Scope for Action. Investigations of Individualization and Institutionalization of Biographies in Modern Times. (Handlungsspielräume Untersuchungen zur Individualisierung und Institutionalisierung von Lebensläufen in der Modernität.) Stuttgart 1983, p. 3. — ² Berger, P. / Berger, B. / Kerner, H.: Discomfort in Modern Times. (Das Unbehagen in der Modernität.) Frankfurt 1975. — ³ Weber-Kellermann, I.: The German Family. Attempt at Social History. (Die Deutsche Familie. Versuch einer Sozialgeschichte.) Frankfurt 1974, p. 107. — ⁴ Lasch, C.: Haven in a Heartless World. The Family Besieged. New York 1977. — ⁵ For example, Wagner, L.: Marriage. Love One Another — Let Another Be. (Ehe. Einander lieben — einander lassen.) Munich 1986. — ⁶ Schellenbaum, P.: Refusal Love. Limits and Devotion in the Erotic Relationship. (Das Nein in der Liebe. Abgrenzung und Hingabe in der erotischen Beziehung.) Stuttgart 1986, pp. 142 ff. — ⁷ Beck, U.: The Risk Society. On the Way to Another Modern Age. (Risikogesellschaft. Auf dem Weg in eine andere Moderne.) Frankfurt 1986. — ⁸ Sackville-West, V.: A Woman of Forty. (Eine Frau von vierzig Jahren.) Frankfurt 1986, p. 193. — ⁹ Hermann Hesse, cit. in Kleine, C.: Between the World and the Magic Garden. (Zwischen Hesse, Frankfurter, Ohnmacht, Cliffs, The Vier, The Sünden, Underliche, Frau.) (Ref. pp. 1986, Youth)

schen Welt und Zaubergarten.) Ninon and Hermann Hesse: *A Life in Dialogue*. (Ein Leben im Dialog.) Frankfurt 1988, p. 316. —¹⁰ Honegger, C. / Heintz, R. (edd.): *The Cunning of Weakness. The Social History of Forms of Female Resistance*. (Listen der Ohnmacht. Zur Sozialgeschichte weiblicher Widerstandsformen.) Frankfurt 1981. —¹¹ Safilios-Rothschild, C.: *Love, Sex and Sexual Roles*. Eaglewood Cliffs / New Jersey 1977. Chapter 3: Men as Objects: The Vengeance of the Victim. —¹² Baker Miller, J.: *The Strength of Female Weakness. Towards a New Understanding of the Woman*. (Die Stärke weiblicher Schwäche. Zu einem neuen Verständnis der Frau.) Frankfurt 1977. —¹³ Safilios-Rothschild, C. (Ref. 11), p. 3. —¹⁴ Sackville-West, V. (Ref. 8), pp. 141 ff. —¹⁵ Mitterauer, M.: *Social History of Youth*. (Sozialgeschichte der Jugend.) Frankfurt 1986, pp. 85 ff. —¹⁶ Extracts from an Interview with

Friedan, B.: *The Feminine Mystique*. New York 1977, pp. 16, 17, 23. —¹⁷ Ibid. p. 332. —¹⁸ Duden, A.: *Transition*. (Übergang.) Berlin 1982, pp. 117 and 119. —¹⁹ Jannberg, J.: *I am myself. (Ich bin ich.)* Frankfurt 1982. —²⁰ Norwood, R.: *When Women Love too Much*. (Wenn Frauen zu sehr lieben.) Reinbek 1986. —²¹ Vaughan, D.: *When Love has no Future*. (Wenn Liebe keine Zukunft hat.) Reinbek 1988. —²² Heller, E.: *With the Next Man it will be quite Different*. (Beim nächsten Mann wird alles anders.) Frankfurt 1986. —²³ Interview with Jean Baker Miller. In Ms. July 1985, p. 67. —²⁴ Christa Wolf, cit. in Gerhardt, M.: *Introduction*. In: R. Varnhagen: *Every Wish is called Frivolity. Letters and Diaries. Selected and Published by Marlies Gerhardt*. (Jeder Wunsch wird Frivolidät genannt. Briefe und Tagebücher. Ausgewählt und herausgegeben von Marlies Gerhardt.) Darmstadt 1983, p. 7.

Biographie:
n: A. We
ions of t
of Biog
spielräum
nd Insti
Modern
r, B. / K
Das Un
—³ We
tempt at
e. Versc
p. 107.
The Fam
le, Wach
— Let O
mander la
Refusal
c Relation
g und Ha
rtgart 199
ty. On th
esellschaft
Frankfu
of Four
furt 198
Kleine, G
den. (Zw

Are Climatic Changes Predictable?

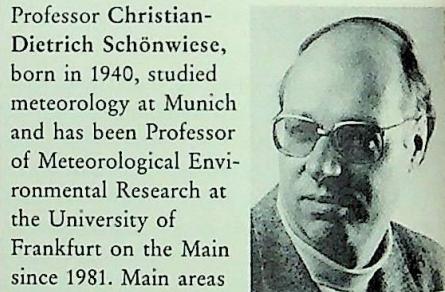
Christian-Dietrich Schönwiese, Frankfurt on the Main

The future has always fascinated mankind, even more so than the past. However predictions are unreliable; they succeed only within a narrow context and are often wrong. In the natural sciences there is a contrast between the certain or almost certain predictions of astronomy and the unreliable forecasts of atmospheric behaviour such as the weather. Climatic prediction lies beyond the theoretical range of weather forecasting and is always qualified. Such predictions can be about the death of the earth through heat or cold or the appearance of the next Ice Age, or about anthropogenic effects such as the "nuclear winter" or the "greenhouse effect". The latter emphasize human responsibility.

It is now twenty years ago that Carl-Friedrich von Weizsäcker gave his famous lecture on the "Art of Prediction". In this he addressed, none too seriously, the question of the identity of the first forecaster of the future. Probably not the first, but at least a very early forecaster was Thales of Milet, who predicted for 585 B. C. an eclipse of the sun, which actually occurred. According to von Weizsäcker: "Thales knew as well as one can know anything that an eclipse of the sun would take place; what he did not know was if they would be able to observe the sun on this day, because that depended on

whether the sky was cloudy. For some mysterious reason the weather is more complicated than the procession of the stars in the sky. One can be predicted, the other not, or only with difficulty."

Professor Christian-Dietrich Schönwiese, born in 1940, studied meteorology at Munich and has been Professor of Meteorological Environmental Research at the University of Frankfurt on the Main since 1981. Main areas of work: statistical analysis of recent climatic history, natural causes of climatic fluctuations, interactions between the biosphere and the atmosphere, anthropogenic effects on world climate. At the moment Dean of the Faculty of Earth Sciences, co-editor of the journal "Theoretical and Applied Climatology" (Vienna), advisor to the German programme on climatic research. Books published: Climatic Fluctuations, 1979; Practical Statistics for Meteorologists and Earth Scientists, 1985; The Greenhouse Effect - Man Changes the Climate (with B. Diekmann), 1987; Climatology: Basic Principles and New Developments, 1988; The Changing Climate, 1992.



Prof. Dr. Ch.-D. Schönwiese,
Institut für Meteorologie und Geophysik
der Universität Frankfurt, Praunheimer Landstraße 70, 6000 Frankfurt on the Main/Germany

The Problem of the Degrees of Freedom

Now the weather is not *so* mysterious and can be predicted within limits. It is however more complicated than astronomical events and this is connected to the number of degrees of freedom.

To understand this let us imagine a sphere which is attached to a track, on which it can move either forwards or backwards. If the track is straight this corresponds physically to a single dimension. If the initial position of the sphere is characterized as "zero", forward motion along the axis of the track is positive and backwards motion is negative. If we tip the track a little then, as a result of gravity, the sphere can only move in one direction, corresponding to a single "degree of freedom" in the single dimension. The movements of the planets on their "tracks" round the sun and of the moons on their "tracks" round the planets are very similar to this and only a little more complicated.

If we remove our sphere from the track, so that it now sits on a table, we have a second dimension. Expressed geographically, one dimension could be the west-east direction and the second north-south. The freedom to move in both dimensions allows our sphere many more variants for its motion. Let us divide our table into an arbitrary number of fields (16 or 100 or a million). As a result of some undefined external effect our sphere could be in any of these fields after a certain time. The number of these fields (strictly speaking less the field in which the sphere was at the start) is the statistical number of degrees of freedom. This obviously depends on how finely we want to resolve the position of the sphere on the table.

The Complexity of the Weather

With an air molecule or a larger volume of air in our atmosphere there is now a third dimension, namely vertical movement, and the number of degrees of freedom is correspondingly raised. We have now moved into the area of meteorology, which covers much more than air movements, the "wind". Even if we reduce meteorology to the weather we still have to discuss temperature, water vapour content (= moisture), liquid water and ice content (sometimes visible as clouds), pressure and precipitation as the most important "weather elements".

To extend the analogy with the sphere, we can imagine spheres of different colour, a green one for air pressure, a red one for air temperature, a blue one for wind, and so on. At a certain time all these spheres lie on definite fields on the table or in the three dimensional space, which correspond to their initial values measured in the atmosphere. The "synoptic" (total) number of degrees of freedom can then be calculated according to the mathematics of combinations (for example $100^6 = 10^{12}$ for 100 fields for each of the 6 weather elements).

In meteorological reality the different spheres are not independent of each other. For example, when air moves upwards it becomes cooler; for physical reasons warming is excluded (i. e. with a closed system or in an adiabatic process). Also there are certain trends towards conservation (autocorrelations from the statistical view point) which forbid arbitrarily large changes within a short time. This reduces the numbers of degrees of freedom. In spite of this their number is very high, or even gigantic, when we remember that the air in the atmosphere does not consist of a single molecule or definite volumes defined in some way,

but of very many components, each with very many degrees of freedom.

A further complication results from the attempt to separate cause from effect. Highly simplified, one can see the situation as follows. As a result of a certain amount of solar energy (an external influence on the atmospheric system) three dimensional movements occur, the so-called atmospheric circulation, and this has certain effects on the weather, namely definite values for the temperature, precipitation etc. at individual locations on the surface of the earth. On the other hand the changes in temperature in the neighbourhood of the earth, which have occurred for any reason, and which have up to now been seen as effect, can themselves cause changes in circulation and thus in the weather. In fact the different causes are connected to each other to a large extent and the effects are coupled with the causes, giving a highly complicated "net-work system".

Limitations of Weather Forecasting

We are familiar with the results of the methods of weather forecasting from the daily "weather report". These methods are based on measurement of the so-called initial state of the atmosphere at a certain time, followed by a mathematical extrapolation into the future with definite steps in time (usually of some minutes). For this extrapolation the physical laws of the system, particularly of the circulation, must be used. Seen mathematically this means that the complex of causes and weather elements is treated by means of equations (in fact "prognostic" equations which include time) in order to calculate trends in the weather. Because of the complexity of these equations the desired values (the weather elements in the fu-

ture) can only be calculated approximately.

To master this problem profound simplifications must be introduced. The most important are:

- Not all, but only a selection from the complex of causes and weather elements are treated.

- Not all known relationships are included. There are of course also unknown relationships which *certainly* cannot be included.

- The spatial resolution is very restricted.

Such simplifications are typical of the "models". As the circulation is of primary importance one speaks of general circulation models (GCMs).

In the usual GCMs of weather forecasting the spatial resolution is conveniently of some hundred kilometres. One must imagine a regular grid like a hair net placed over the earth. All relevant meteorological elements are then calculated for each element in the grid in steps in time up to perhaps 24 hours in the future. To include the third spatial dimension a system of these hair nets must be placed on top of each other from the earth up to the lower stratosphere, at a height of about 20 kilometers. A rough calculation, with a net of 200 by 200 kilometers, with ten layers in the model, and ten parameters for the state of the individual components, gives the result that the total system must be defined by ten million parameters. For each of these there are the many degrees of freedom which have already discussed and which must be extrapolated into the future, in steps and approximately. This is clearly an enormous undertaking, for which the biggest computers in the world would hardly be adequate. Many scientists are in fact right when they maintain that the

weather system is one of the most complicated systems in natural science. But even worse is in store for us, in the "climatic system".

First however we must edge our way towards the limits of weather forecasting. These days the 24 hour weather forecast is 85 per cent accurate, which is actually not bad in comparison with economic and political prediction. However the further we dare to look into the future the lower the reliability becomes.

This is a result of the physical simplifications. It is particularly significant that of the 18 decimal orders of magnitude found in nature (from 10^{-10} meters on the molecular scale to 10^7 meters on the global scale), only three are covered by the circulation models (GCMs). The excluded "subscalar" effects grow, force their way into the "model scale" and cause the calculations from the model and reality to drift further and further apart.

Secondly there are causes of numerical error which lead to increases in the errors in estimation with the mathematical techniques used for approximation. All in all and without discussing details, theoretical meteorologists have estimated that the theoretical limit of weather forecasting — "theoretical" means with the greatest conceivable expenditure on the model — must be about a month. At the moment this means in practice some days, perhaps ten days for very rough forecasts.

The Transition to Climate

It is internationally understood that the "climate" lies beyond this limit. The term "climate" means an average of the weather over days or months, but includes statements on statistical variations in, for example, mean daily changes. "Climate"

therefore sets a lower time threshold for the resolution of atmospheric phenomena. There is no corresponding upper time limit, which means that "climatology" covers periods up to the age of the earth, namely about 4,6 thousand million years.

From the physical point of view there is thus no essential difference between weather and climate, just that climate and its changes extend over much greater periods of time than does weather. Thus causes of variation play a role which in short and long term weather are unimportant. Examples of these would be continental drift or long term changes in volcanic activity or in solar radiation. Finally processes in the ice of the earth (cryosphere), and in the land (long term processes such as continental drift) and in the biosphere (particularly vegetation) must be "coupled" with the atmosphere, with the result that a much more inclusive "climatic system" is derived from the "weather system".

It will now be quite clear that the self-appointed forecasters who prophesy summer or winter weather for months in advance belong in the same box as the inventors of perpetual motion. Even if the newspapers go wild about such achievements: they are fairy tales. We must thus draw the logical conclusion that changes in climate cannot be predicted.

Two "Dead Certain" Climatic Forecasts

What is correct in this inference is that predictions of the multifarious and complex events in the atmosphere beyond the theoretical limit of a month cannot now (and will never be able to) be made stepwise on the basis of circulation models (GCMs) or of other less complicated techniques. There is however still the

possibility of conditional forecasting. The condition is that a definite cause within the multifarious cause-effect complex increases its influence to such an extent that it clearly dominates over all other mechanisms. Moreover the behaviour of this dominant effect must be predictable, either with certainty or with high probability.

When we think once more of the eclipse of the sun it is not surprising that the most convincing approaches to such conditional climatic forecasts have been in the realm of astronomy. They are connected with the life history of the sun, the irradiated energy of which, coupled to a favourable distance from the sun, permits the existence of life. Now nothing on earth or in the universe is eternal, and this includes the life of our sun. The sun's fuel is hydrogen, from which it forms helium, like a gigantic fusion reactor. Astronomers estimate that the sun will have consumed all its hydrogen within about five thousand millions years and will then extinguish. Without any doubt this means that the earth will then freeze to death.

There is a second prediction which is no less drastic and which is also based on astronomy, namely that the aging sun will become hotter and hotter. This is because the zone of the nuclear reaction, which is now in the interior of the sun, will extend more and more towards the outside as the store of hydrogen becomes less. This means then that the sun becomes not only ever hotter but also ever bigger. It is estimated that as a result of this the mean temperature of the earth's surface, which is now +15 °C, will rise to +50 °C in about two to three thousand million years, and will cross the 100 °C mark in four to five thousand million years. This means the loss of all water and finally death from heat — a relatively short time

before the death from cold described above. Thus, before its collapse and death as a "white" or "black dwarf", the sun will expand gigantically and, in the form of a "red giant", will swallow the earth.

The Next Ice Age Will Definitely Come

Now the next thousands of millions of years are so inconceivably far in the future that we must still ask ourselves: What will happen before this? Also the relativity of the two climatic forecasts we have made is evident, as the death of cold of the earth has no significance whatsoever if it has already died of heat.

There are in fact also possibilities of climatic forecasting for the not quite distant future, of course again in the sense of conditional forecast. For the last ten years hardly any doubt has remained that the coming and going of the "ages" (cold periods, glacials) and the intervening warm periods (interglacials) are connected with the fluctuations of the earth's orbit round the sun. These fluctuations of the so-called orbital parameters (eccentricity of the orbit, inclination of the axis of the earth, direction of the earth's axis) exhibit cycles of between about 20 000 and 100 000 years. They cause considerable variations in solar radiation (particularly its distribution over the earth's surface) and within this order of time they take on a dominant character.

As early as 1920 the Yugoslavian mathematician Milankovitch attempted to develop an Ice Age hypothesis on this basis. This has however been convincingly successful only more recently, with the availability of climatic modelling and the possibility of considering feed-back effects (particularly between the atmosphere and

the cryosphere) and sensitivity characteristics (different reactivity of the climate in different regions and at different seasons). For example, with the help of climatic models, it has been possible to simulate the climate of 18 000 years ago, at the climax of the last Ice Age (Würm "Ice Age"), in a satisfactory fashion. At this time the areas of ice on the earth were about three times as large as today, with for example ice over all of North America, Scandinavia, almost all of England and elsewhere. This then caused a drop in the sea level of about 140 meters, with the resulting disappearance of for example parts of the North Sea. The mean global annual temperature was then about 5 °C lower than today.

However to compute the course of climatic fluctuations within a reasonable time one has to dispense with using circulation models (GCMs). The corresponding "transient" models are therefore based on drastically simplified simulations of the energy balance. It has nevertheless been possible in this way successfully to sketch the climatic history of the last hundreds of thousands of years, including the peak of the last warm period about 120 000 years ago (Eem warm period), the appearance of the last cold period about 70 000 years ago (Würm "Ice Age"), its climax about 18 000 years ago and its end about 11 000 years ago.

Our present warm period passed its peak some millenia ago and there can hardly be any doubt that we are moving towards a new "Ice Age". There is also no doubt, if the climatic models are correct, that the climax of the next Ice Age will be in roughly 60 000 years. This is a further conditional climatic forecast. That its reliability is only relative becomes clear when one expresses the forecast as a trend in temperature: namely of about

0,01 °C per century, for the northern hemisphere or for the mean annual temperature of the earth. Even if we ignore the moods of the weather by taking values averaged over many years there have still been fluctuations in the last 10 000 years of about 1 to 2 °C (again for the mean hemispherical or global temperature). Although these fluctuations have serious social and economic consequences there have hardly been attempts to forecast them. It is also clear that they are very much greater than the trend which is leading us to the next "Ice Age". Thus, however interesting the "Ice Age" problem is from the scientific point of view, it has very little significance for the climate in the next decades or centuries.

The Nuclear Winter

We must now consider the influence of man, which is unfortunately far from admirable. Of course we all hope that the most recent developments in east-west politics will save us from the horror scenario of a nuclear world war. Nevertheless climatologists have studied this problem in detail and once again developed conditional climatological forecasts. It does seem that these studies have succeeded in raising the inhibitory threshold for such a misanthropic madness.

These studies are again based on climatic models, in fact on the more detailed atmospheric circulation models (GCMs). Most scenarios start with the assumption that explosions and fires will cause the release of three to five million tons of dust and soot, initially into the lower atmosphere, which means up to about five kilometers. This would be mostly in the middle latitudes of the northern hemisphere. The resulting attenuation of solar radiation in these latitu-

des would result in a drop in temperature of about 15 to 20 °C, so that summer might suddenly change into "nuclear winter".

After some months the particles of dust and soot would reach the stratosphere (above about ten kilometers from the surface) and then would be distributed throughout the world. The drop in temperature would then not be so marked but would be perceptible everywhere. The first calculations based on climatic models suggested that an atomic world war could lead to an artificial "Ice Age" or could even cause the earth to be totally covered with ice. More recent calculations have not confirmed this. Nevertheless it is really probable that there would be marked cooling by several degrees throughout the world for many years. This would be at least as pronounced as during the "little Ice Age", which reached its extremes in 1600 and 1850, and which caused much more severe winters than today, with cool summers, advancing glaciers and failed harvests. A final possible effect of a worldwide nuclear war concerns the "ozone layer" of the upper atmosphere (stratosphere) which protects us from the biological damage caused by the hard UV radiation from the sun. This could be reduced throughout the earth, which would mean a "nuclear ozone hole".

The Greenhouse Effect

Another anthropogenic scenario, of which scientists have been warning us for at least 100 years and which has also been discussed politically for some years, seems unfortunately to be developing into a reality. The only remaining question is to what extent we are still capable of hindering world-wide climatic changes.

The international conference on atmospheric changes in Toronto (June 1988) went so far as to describe the man-made changes in the atmosphere as an uncontrolled and highly dangerous global experiment, comparable only to a global nuclear war, which would have to be met with immediate and energetic measures.

What is this about? As a result of the consumption of fossil energy (coal, oil, gas), of traffic and of many agricultural, industrial and domestic activities, man causes the emission into the atmosphere near the surface of a series of gases which affect the climate (carbon dioxide, chlorofluorocarbon ozone near the earth's surface, nitrous oxide, methane etc.). This has resulted in a continuous increase in the concentrations of these gases since preindustrial times. Put simply, these gases have the property of allowing the unhindered passage of solar radiation to the earth's surface, but of restricting the radiative loss of heat. This is like a greenhouse and results in the atmosphere near the earth becoming warmer, whereas the upper atmosphere simultaneously becomes colder. Moreover there is strong suspicion that the chlorofluorocarbon have caused the "ozone hole" in the antarctic stratosphere (which now contains much less than half the usual spring concentration of ozone), and increasing also the reductions in stratospheric ozone in the arctic and in other areas (of the order of a few per cent at the moment).

The "greenhouse" problem too can be approached with climatic GCMs, particularly bearing in mind that when the temperature changes so does atmospheric motion and thus the total climate. In spite of all the simplifications in the models at the moment particularly as regards the formation of clouds and rain and oceanic circulation) and the disparate

sults of the simulations, it is still possible to sketch the following scenario of an altered climatic environment, which may be established in about 50 years and which we are gradually approaching if we continue to act in the same way:

— Increase in the air temperature near the earth, averaged worldwide and over all seasons, by 1,5 to 4,5 °C, with relatively small changes in the tropics but with twice or more these changes in the temperate and sub-polar zones in winter.

— A rise in the sea level, averaged over the earth, of about 10 to 30 centimeters, with a longer term upper risk threshold of about 1 meter.

— A decrease in precipitation coupled to the risk of continuous drought in the subtropics, including the Mediterranean area and the southern states of the USA, particularly the relatively continental area of the mid-west with the main areas for the cultivation of crops.

— Increase in precipitation in the temperate to polar latitudes, possibly coupled to increased tendency to showers, storms and hail in moderate latitudes.

The differences between the regions here are very uncertain, particularly when they go beyond changes in temperature and sea level. Predictions about more frequent strom floods, whirlwinds and so on are particularly unreliable.

The condition for such climatic changes actually to appear is that the climatic factor "man" becomes dominant over natural climatic fluctuations within the time span of interest. We could be so far within twenty, or even ten, years. Remedial or protective measures would however then be much too late, as the climate of the earth presumably reacts with a lag of some decades to the increases in atmospheric concentration of the climatically active trace gases.

The point of this discussion is that it is not only possible to predict climatic changes within certain limits; it is necessary to do this to help in political decisions. In spite of all the uncertainties, particularly quantitative, in the climatic forecasts which we have discussed here, we must come as rapidly as possible to the insight that responsibility for our environment and for our progeny forbids us to alter and to burden the atmosphere of the earth as we have been doing till now in ever growing greater intensity.

English translation by R. A. Yeates

Literature

- von Weizsäcker, C.-F.*: The Art of Prediction. Lecture at the Annual Meeting of the Society for the Support of German Science. (*Über die Kunst der Prognose. Vortrag anlässlich der Jahresversammlung des Stifterverbandes für die Deutsche Wissenschaft.*) Unpublished special edition of the lecture, 1968. — *Schönwiese, C.-D.*: Practical Statistics. (*Praktische Statistik.*) Stuttgart 1985. — *Fortak, H.*: Meteorology. (*Meteorologie.*) Berlin 1982. — *Reuter, H.*: The Science of Weather. (*Die Wissenschaft vom Wetter.*) Berlin/Heidelberg/New York 1968; ibid.: The Weather Forecast. (*Die Wettervorhersage.*) Vienna/New York 1976. — *Fischer, G.* (ed.): Landolt-Börnstein, New Series, Volume 4 Meteorology, Subvolume c1 Climatology, Part 1. Berlin/Heidelberg/New York/London/Paris/Tokyo 1987; here: *Schönwiese, C.-D.*: Climatic Variations. pp. 93 to 150. — *Schönwiese, C.-D.*: Climatic Fluctuations. (*Klimaschwankungen.*) Berlin/Heidelberg/New York 1979. — *Smoluchowski, R.*: The Solar System. (*Das Sonnensystem.*) Heidelberg 1985. — *Berger, A.* et al. (eds.): Milankovitch and Climate. Parts 1, 2. Dordrecht/Boston/London 1984. — *Golitsyn, G. S./MacCracken, M. C.*: Possible Climatic Consequences of a Major Nuclear War. World Meteorol. Org., Publ. WCP-142. Geneva 1987. — *Schönwiese, C.-D./Diekmann, B.*: The Greenhouse Effect. Man Changes the Climate. (*Der Treibhauseffekt. Der Mensch ändert das Klima.*) Stuttgart 1988. — Government of Canada/Environment Canada: The Changing Atmosphere: Implications for Global Security. Conference Statement. Toronto 1988. — IPCC (Intergovernmental Panel on Climate Change), *Houghton, J. T.* et al., eds.: Climate Change. Cambridge 1990.

How does the Biological Clock Tick?

Life Span and Biological Time

Roland Prinzing, Frankfurt on the Main

Our life span is restricted. Everyone knows this and everyone accepts this as "biologically" obvious. "Nothing lives for ever!" However in this statement we think of artificially produced, technical objects; products which are subjected to natural wear and tear during use. This wear and tear leads to the result that at some time or other the object stops working and is unusable ("death" in the biological sense). But are the wear and tear and loss of function of technical objects and the death of living organisms really similar or comparable?

The two processes are fundamentally different. Our "dead" products are "static" closed systems. It is always the basic material which constitutes the object and which in the natural course of things is worn down and becomes "older". Aging in this case must occur according to the laws of physical chemistry and of thermodynamics. Although the same law holds for a living organism the result of this law is not inexorable in the same way. At least as long as a biological system has the ability to renew itself it could actually become older without aging. An organism is namely an open, dynamic system through which new material continuously flows. Destruction of old material and formation of new material are thus in permanent dynamic equilibrium.

Thus the material of which the organism is formed changes continuously. Within about seven years a human being is "newed" to about 90 per cent, i. e. he is constituted to about 90 per cent of totally

Professor Roland Prinzing, born in 1948, has been Professor at the University of Frankfurt on the Main since 1984, where he heads the research group on metabolic physiology in the Department of Zoology. His studies are directly

related to the broad theme of thermoregulation and energy balance in homothermic organisms. Apart from this basic research he also works on more applied problems, including those related to ecotoxicology and the protection of the environment and of species. Professor Prinzing studied chemistry and biology at Tübingen, with an additional course for teaching at grammar schools. Before he came to Frankfurt he worked as scientific assistant, took his doctorate on the metabolic physiology of birds and was then university lecturer. His important books are as follows: a monograph on the black-necked grebe, a review on the effects of pesticides on avian reproductive physiology and the text book "Ornithology" (with E. Bezzel).

Professor Roland Prinzing, AK Stoffwechselphysiologie, Universität Frankfurt, Siesmayerstraße 70, 6000 Frankfurt on the Main, Germany



material. Thus our bodies continuously exchange old substance for new, just like a spring which more or less maintains its form and movement, but in which the water molecules are always different.

Immortality is Undesired

Thus aging and death should not be seen as inevitable, particularly as the organism possesses many mechanisms for repair. It is not in principle necessary that a biological system should age and die.

Nevertheless a restricted life span, aging and then death are a basic characteristic of life. The reason for this is easy to recognize: in nature the existent organisms are regularly replaced by new types. Because of changes in the genetic material (mutations) these have new characteristics and in the course of their individual lives they are tested for optimal or better adaptation to the environmental conditions. Immortality would disturb this system — it needs room for new and better life. This is the basic problem of evolution.

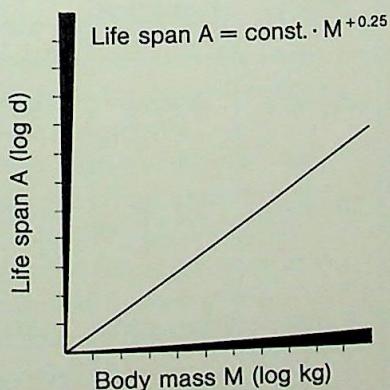
Thus death is a basic precondition for

the frictionless and rapid development towards better adaptation to the dominant environmental conditions.

The restriction of life by death is then sensibly not left to chance, such as disease, accident or falling prey. It is thus evidently an inherent property of the system of the organism from the first moment of its development. Life span and death are thus programmed from the start of life. This is known as the hypothesis of genetically programmed aging, ending in death, and is not particularly controversial among scientists. The theory does not necessarily posit aging in the sense of slow loss of function before death. Many organisms even die at the zenith of their physiological abilities. For example, many sorts of plant die after flowering and many insects, fish and worms immediately after reproduction. This is a particularly clear demonstration of the programmatic character of death.

The rare "progeria", a hereditary human disease which leads to premature aging, is a further very clear demonstration of the genetic basis of the aging process.

Life Span and Body Mass



Examples (in years)	
Bacteria *	0,0003
Single celled organisms *	0,005
Beetles	0,5
Mouse	3–4
Rat	5–8
Dog	14–25
Cow	30–40
Elephant	60–70
Whale	80–100

* To the next division

Fig. 1: The mathematical relationship between life span and body mass, with some individual examples (rough approximations). This correlation is valid for practically all organisms. Only the constant factor is somewhat different in different systematic subdivisions, leading to a slight parallel displacement of the curve, either upwards or downwards.

This thesis is further supported by the observation that every organism has a life span which is highly characteristic. There are striking differences in life span between different species, but within one species the parameter is relatively constant. For example, the average duration of human life has hardly changed in thousands of years. Although more and more people attain an advanced age as a result of improvements in medical care and better nutrition, the characteristic upper limit for most remains the four score years mentioned in the Bible. In this country women reach an average of 81 and men 74 years (1991). In other words the typical limits are also genetically fixed for the two sexes. This is valid for man in all cultures and for all races, but also similarly for animals, as far as is known.

A further argument against the simple wear and tear theory is the observation that the time within which organisms age lie between a few days (even a few hours for unicellular organisms) and several thousand years, as with mammoth trees.

How does the Biological Clock Tick?

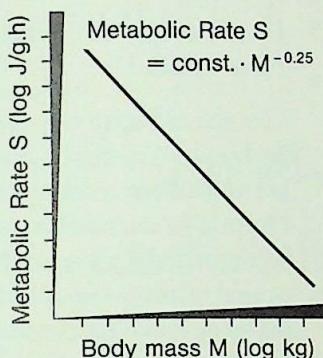
If a life span is a genetically determined biological characteristic it is logically necessary to propose the existence of an internal clock, which in some way measures and controls the aging process and which finally determines death as the last step in a fixed programme. This last step can of course consist of a long succession of different processes. Its implementation will not be further analysed. Instead I shall concentrate solely on the site and function of the "clock" for life span and on the question of the unit and beat in which the clock "ticks". Additionally there is a large number of theories on the control and bases of the aging processes. Some of the more important will be briefly introduced.

■ The "Mutation Theory" proposes that the genetic material (the sum of the chromosomes) is so strongly altered, both spontaneously and by external factors, that the organism ages by a sort of chemical wear and tear. The possibility of repairing the genetic material is not considered.

Phases of the Life of an Animal

Phase	Units		Range
	physical (d, y)	physiological (kJ/g)	
Embryogeny	10–90 d	2 ± 0.8	9/2.3
Ontogeny	20–300 d	20–40	15/2.0
Adult Stage	8–120 y	2400–4300	15/1.8

Tab. 1: Comparison of the duration of the life phases of birds in physical and physiological units. With "range" is to be understood the maximal scatter of the two parameters. It is obvious that the physiological time for all phases lies within a very narrow range, in contrast to the physical time. d = days, y = years, kJ = kilojoules, g = grammes. From Prinzing (1991).

Metabolic Rate and Body Mass

Examples (in J/g.h)	
Humming bird	200
Tit	80
Finch	66
Mouse	34
Rat	20
Dog	7.2
Cow	2.4
Elephant	1.4
Whale	0.3*

*Approximate calculated value

Fig. 2: The mathematical correlation between metabolic rate and body mass with individual examples. See text for detailed explanation.

Many experiments, particularly those involving production of genetic changes by radioactivity, show that this theory alone is not tenable. Even very high mutation rates have little effect on the life span.

- I have already argued that the “wear and tear” theory is not very convincing. Like the other theories it has great difficulties in providing a reasonable explanation for the very different life spans.

- The theory of the “species specific restricted ability of cells to divide” is based on the observation that normal cells in tissue culture only divide a defined number of times and then die. As these results are only valid for isolated cells they are unsuitable as a general basis for aging in complicated multicellular organisms.

- There is also a large number of other theories (occurrence of free radicals in the body, loss of immunity etc.). An up-to-date summary can be found for example in Goldstein, Gallo and Reichel (1989).

In these theories it is always difficult to decide whether the phenomenon discussed is itself the clock or whether it is one of the subsidiary mechanisms for causing death which are themselves steered by the

clock. The latter could evidently be quite different in different organisms, while the “clock” itself should have a fairly unitary structure for all organisms.

Comparison of Life Span

The “theory of the maximum rate of life” was proposed by the German physiologist Rubner as early as 1908 and has as yet received little attention in aging research (gerontology). I would like to describe this theory on the basis of some phenomena which we have either discovered or confirmed in our department. These are readily comprehensible and evidently valid for all organisms.

The life of most higher organisms can be divided into three distinct phases: the development of the embryo (embryogeny), the development of the young animal (ontogeny) and the phase as adult (adult phase). We have examined the metabolic physiology of these phases more closely, using birds as examples. Each of these phases can be defined by a discrete life span, which is very different in different species. As our measure of time we took

the normal physical units of days, months and years. Embryogeny in birds lasts between 9 and 94 days, ontogeny between 20 and 300 days and the adult phase between a few years (wren) up to 80 to 100 years (birds of prey, parrots). The physical life span is thus very different in the different groups (Tab. 1). The duration of each phase is dependent on its mass, i. e. the greater the mass of its body (M) the longer it lives (Figs. 1, 5). The mathematical correlation can be expressed simply as follows:

life span (A) = $a \cdot \text{mass } (M)^{0.25}$
(a is a constant, the same is true of b and c in the equations below; examples of their real values are given in the figures).

But does the organism measure its life

span in days or years, in physical units? In my opinion the answer is a clear "No".

Does Energy Consumption Beat the Time of Life?

Like the life span the energy turnover per body mass ("metabolic rate") has for different organisms a fixed mathematical relationship to the body mass. Like the correlation with the life span this too is an exponential relationship and is also in principle the same for all species and for all phases of development (Fig. 2):

$$\text{Metabolic rate, } S = b \cdot (\text{Mass})^{M^{-0.25}}$$

In comparison to the life span this relationship is "inverted": the larger the orga-

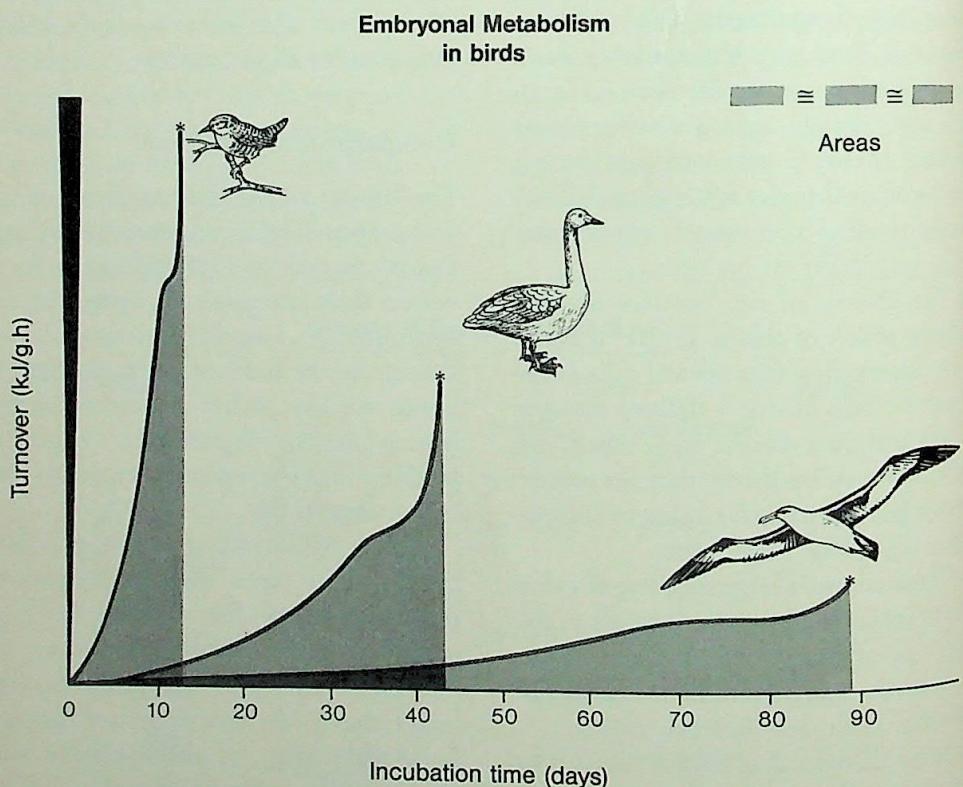


Fig. 3: Schematic representation of energy metabolism during embryonal development in birds. From left to right: wren, mute swan, albatross. Although the duration of embryogenesis is very different in the three birds the total converted energy per unit body mass to hatching is practically identical.

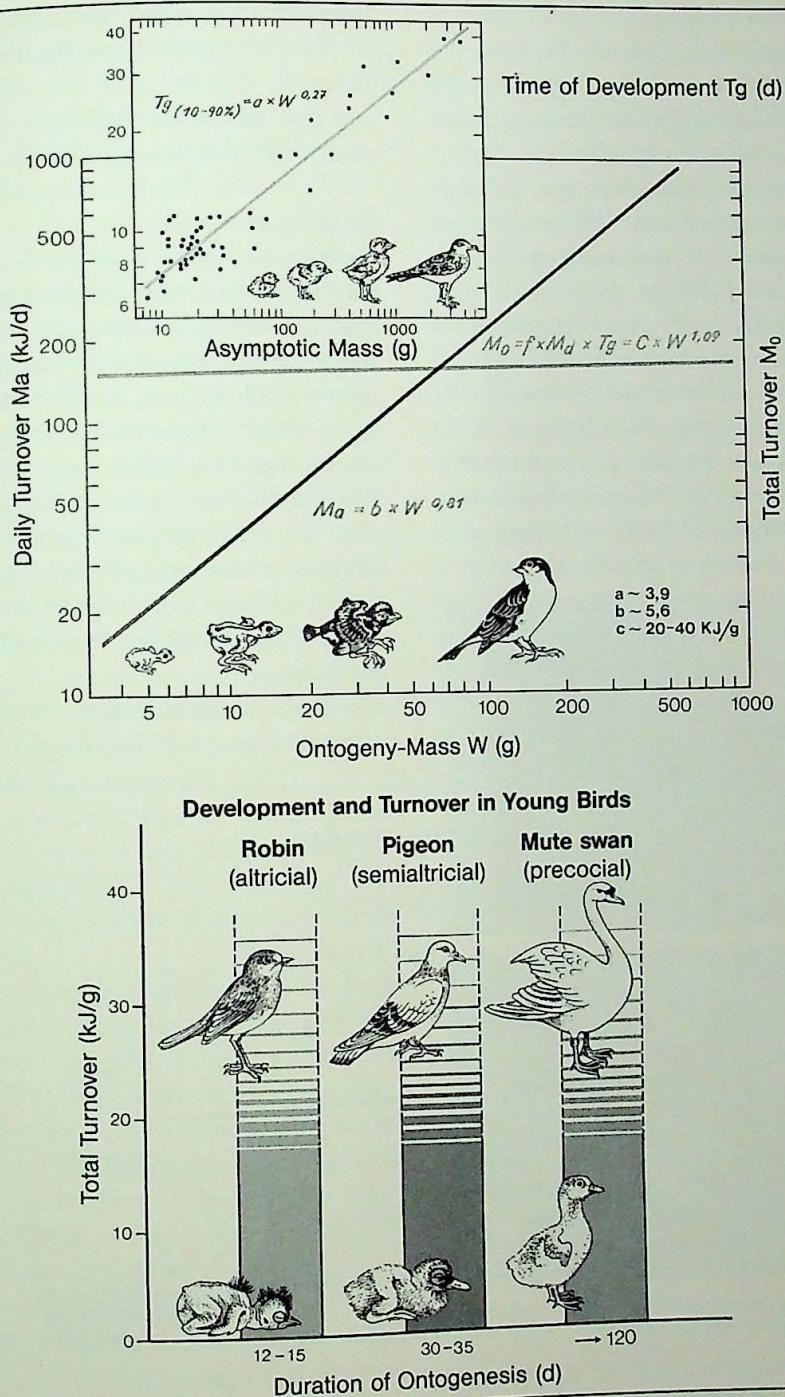


Fig. 4: The upper figure shows how the total turnover during ontogeny can be determined. The total turnover, M_0 , can be calculated from the above formula, given the time of development, T_g (time of growth from 10 to 90 per cent of the final body mass) and the corresponding daily turnover, M_d . The value of M_0 is a constant which is independent of the duration of ontogeny and mass during ontogeny. The lower figure illustrates this with three birds with different modes of development and different durations of development. In all three species metabolic rate during ontogeny lies between 20 and 40 kilojoules per gramm.

ism the lower its metabolic rate. Again this relationship is valid not only for birds, but also similarly on average within the systematic unit for all other organisms (plants, animals, unicellular organisms).

If you then calculate how much energy is consumed in its total life span by, for example, a bird you come to an amazing result. However different the physical time spans are the quantity of energy consumed is practically identical for the different species and within the different phases of life (Tab. 1). Expressed differently, a zebra finch consumes exactly as much energy during its 12-day embryogenesis as a king albatross during its 90-day embryogenesis. During its 4 years of adulthood the wren "experiences" as much energy as the grey parrot in its 80 years of life. Thus from the physiological point of view the two become equally old (Figs. 3 to 5)! This is also evident from the product of the two equa-

tions for "life span" and for "metabolic rate" which together give the life turnover

$L = A \cdot S = a \cdot b \cdot M^{+0.25} \cdot M^{-0.25} = c$

c is a constant. We therefore reach a constant physiological age and the organism works its way through a roughly constant quantity of energy.

These findings are very well established on the basis of extensive data from more than a hundred different species. As with the metabolic rate this relationship is evidently valid not only for birds but also for many other organisms, including man (on the average and within a systematic unit). Many individual examples can be listed:

- The life span (time to the next division) of many unicellular organisms halved when their metabolic rate doubled by raising the temperature of the medium.

- Animals which behave "frugally" with energy become particularly old. The slugs

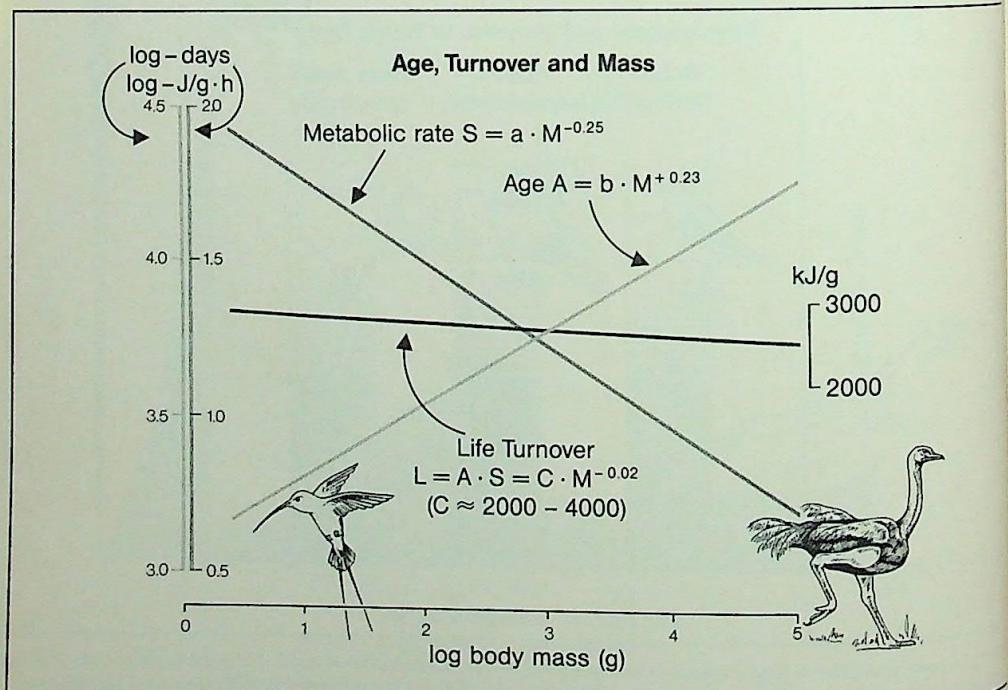


Fig. 5: The dependence in birds of the age, mass specific energy turnover and life turnover on the mass (axes in logarithmic units: 0 = 1; 1 = 10; 2 = 100; 3 = 1000; 4 = 10 000; 5 = 100 000). It will be seen that the life turnover, L, is independent of the mass and of the life span, i.e. it is a constant (dark curve). The arrows indicate which axes correspond to which parameters.

gish crocodiles and tortoises are potential animal Methusalems.

- Parrots and birds of prey are often held chained up. Thus they are not able to "experience life" and attain a high life span in captivity.

- Among the invertebrates the highly active octopuses only become 4 to 6 years old. Equally large but immobile shellfish easily reach 20 to 40 years.

- Animals which save energy by hibernation or lethargy (e. g. bats or hedgehogs) live much longer than those which are always active. This is particularly obvious in closely related animals. Thus the white toothed and red toothed shrews can be differentiated by the presence or lack, respectively, of a state of lethargy for saving energy. The white toothed shrews (capable of lethargy) become much older (4 to 6 years) than their almost equally large red toothed relations (2 to 3 years), which are not capable of lethargy (Fig. 6).

- The metabolic rate of mice can be reduced by a very low consumption of food (hunger diet). They then may live twice as long as their sated comrades (cp. Tab. 2).

These examples could be extended endlessly. Some examples of unexpectedly high or low life spans are then revealed as confirmations of, rather than exceptions to, the rule. There are also examples of the application of this theory to man, some of which are surprising. It has already been mentioned that women become distinctly (about 10 per cent) older than men. If you examine the metabolic rates of the two sexes you establish that the higher male metabolic rate roughly accounts for the lower male life span. That means that they life "energetically" more intensively, but not for as long.

Nuns and monks live their lives in total peace, without stress and without much

physical activity, in seclusion in their monasteries or convents. In our country they often become particularly old. On the other hand manual labourers have a low life span; nor do top athletes reach a great age. Like the manual labourers they consume more than average of their metabolic sum through intensive energy consumption. The saying is: "Their candle burns brightly but short". The analogy with the candle is actually not bad. Two candles of identical size burn for different lengths of time, depending on the intensity with which they burn. Their total consumption of energy is in both cases the same. This is a nice example of how the biological clock



Fig. 6: Two shrews with different metabolic strategies. The house shrew, *Crocidura russula* (family of the white toothed shrews), (lower picture) is characterized by rigidity during rest periods during the day (lethargy, torpor). The metabolic rate and body temperature then drop greatly, which allows the animal to save much energy. The house shrew lives about four to six years. Its cousin, the wood shrew, *Sorex araneus* (family of the red toothed shrews), (upper picture) does not have this ability. It lives only between two and three years.

(Photos: Dr. A. Nagel)

counts differently from the physical clock.

Metabolism as General Timing Principle?

What is then special about this theory of maximal metabolic scope? Apart from reproduction and stimulability metabolism is the third basic systemic property of organisms, and thus of life itself. In contrast to the other two properties, metabolism (with which I mean energy metabolism) is moreover practically identical for all living creatures which live in and breathe oxygen — and that means many bacteria, unicellular organisms, plants and animals. This means that all aerobic organisms use identical metabolic pathways with identical metabolic intermediates and enzymes (Fig. 8).

There is thus no difference in principle between a unicellular animal and a man or between a bird and a tree. Such a general system would therefore be very suitable as a timer for life span. As all metabolic pathways contain feedback elements it would not be excessively complicated to imagine

a physiological mechanism for this. To go into more detail would however be beyond the scope of this article. A further positive aspect of this theory is that it is highly accessible to experimental test. It should nevertheless be reiterated: It is only a theory!

Can you Actively Prolong your Life?

The above discussion literally forces us to ask the question if it is possible to extend the life span of the individual. If we exclude factors such as illness, accidents etc. from the discussion there are clearly rules of life which could have this effect. These rules are the same as those passed on by tradition, which suggests that the experience of many generations has drawn the correct conclusions long before experimental science.

It follows from the above that sparing use of energy reserves should tend to extend life. How this should happen in real life is less clear. In our competitive society “to put your feet up” is possible for almost nobody. On the other hand: “Those who

The factors which make for a long life in man

- genetic predisposition
- sex: woman
- large, heavy races
- constitution: leptosomal type (slender limbs)
- sphere of life: moderate climate, peaceful town or village
- marital status: married (of course happily)
- non-smoker
- financially secure, no worries
- mental, not heavy physical work
- reasonable (reduced?) nourishment
- balanced rhythm at work, no stress
- low alcohol consumption (?; presumably connected to a peaceful, relaxed style of life)

Tab. 2: From statistical research.

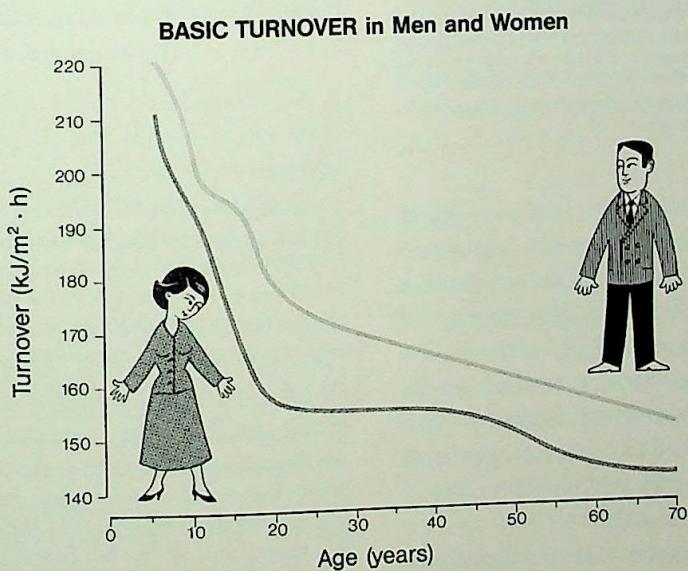
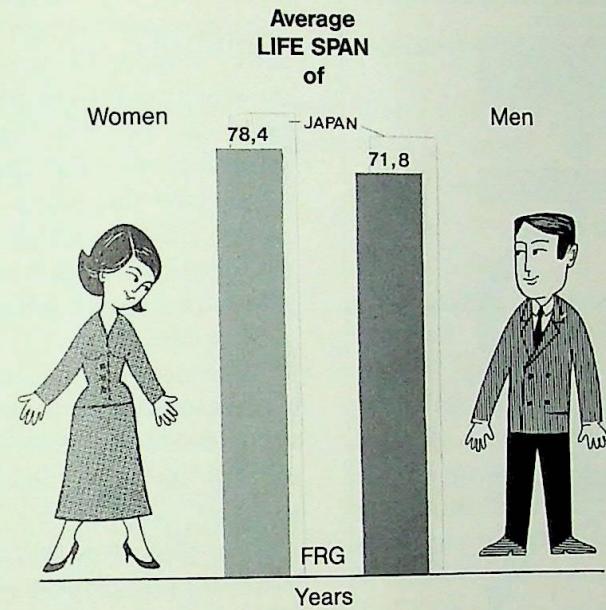


Fig. 7: Upper: In all cultures women become about ten per cent older than men. The figure shows the situation in the former Federal Republic and in Japan (81.8 and 75.7 years, respectively). More recent data from the FRG that women become about 81 and men about 74 – the gap between the two has thus been maintained. Lower: The energy turnover for women is markedly lower than for men. The total energy consumed by men during a lifetime is however about the same in men and in women. Moreover these two effects of sex are also found in animals.

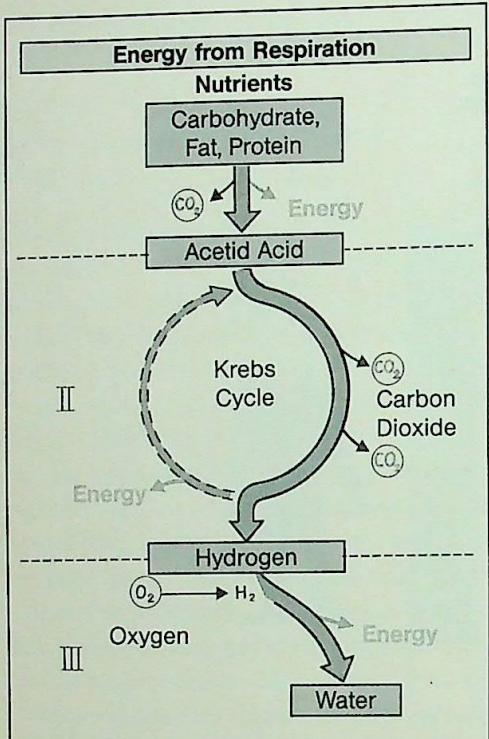


Fig. 8: Schematic representation of energy metabolism in aerobic (oxygen requiring) organisms. Nutrients are metabolized by reaction with oxygen, releasing energy and forming water and carbon dioxide as end products. (I = Glycolysis; II = Citric Acid or Krebs Cycle; III = Respiratory Chain). Energy metabolism is identical in principle in all aerobic organisms.

rest rust". It is at least clear that a variety of energy saving behaviour can be learnt and practised. For example, stress accelerates metabolic rate and one can master its avoidance. Extreme high performance sport may lead to optimal cardiovascular performance, but it quite certainly does not prolong life; as Churchill once said and has been widely repeated in some newspapers, "Sport is murder".

There is a particularly vivid example of the truth that health and long life are not the same. Mrs. Carrie White in the USA is the oldest human being in the world and celebrated her 117th birthday on the 21st November 1991 — and she has spent the last 77 years in hospital. Although such

individual examples should be regarded with caution Mrs. White provides voluntary good support for the metabolic theory of aging. On the other hand, relating jogging after work (in America "working") can be very relaxing for many stressed people. The stress hormones released into the blood during so-called distress maintain metabolism and energy consumption at high level and this can be reversed by jogging, which clearly tends to prolong life.

Relaxation lowers metabolic rate, as does adequate sleep and in general an equal and balanced personality. Each of us can develop his own "energy saving programme" with a little self-observation, critical self-control and, above all, logical consistency. Experience will show that live in this way not only increases the life span but is also very healthy. This final aspect should not be forgotten. If a theory manages that it has managed something

English translation by R. A. Yerushalmi

Literature

- Goldstein, S./J. J. Gallo/W. Reichel (1989): Biological Theories of Aging. AFP (3) 40 : 195 to 201. — Hayflick, L. (1980): The cell biology of human aging. Sci. Am. 242 : 58 to 65. — Prinzinger, R. (1979): Life span and relative energy production in birds (Lebensalter und relative Gesamtenergieproduktion beim Vogel). J. Orn. 120 : 103 to 105. — Prinzinger, R. (1989): The Energy Cost of Life Stages in Birds. In: W. Wieser and E. Gnaiger (eds.): Energy Transformations in Cells and Organisms : 123 to 129. Stuttgart. — Prinzinger (1990): The phases of life and their physiological changes in birds — an allometric view. (Die Lebensstadien und ihre physiologische Zeit bei Vögeln.) J. Orn. 131 : 51 to 61. — Rahn, H. (1989): Time, Energy and Body Size. In: V. Paganelli and L. E. Farhi (eds.): Physiological Function in Special Environments: 203 to 213. New York, Berlin, Heidelberg. — Rubner, M. (1908): The problem of life span and its relationship to growth and nutrition. (Das Problem der Lebensdauer und seine Beziehungen zu Wachstum und Ernährung.) Munich, Berlin.

Thinking as Evolution

Adelbert Reif in conversation with the Nobel prize winner for physics,
Gerd Binnig

The conflict between theological and scientific views of the world has occasioned a great deal of perplexity both among theologians and specialists in the exact sciences. This conflict has hitherto been emphasized by a sharp line of demarcation between the two domains. Gerd Binnig's recently published book, "Aus dem Nichts", gives a picture of the origin of the world which dissolves this traditional opposition, and brings together the ideas of creation and evolution on a new level.

Professor Binnig, what has caused you, a physicist, that is to say, a man of the exact sciences, to give your attention to the problem of the opposition between the theological view of the world and that of the exact sciences?

Binnig: I have never regarded myself as a "typical physicist" or a "typical scientist". From the first I was equally interested in the arts and humane studies. I am, therefore, not caught within the limits of "mathematical formalism"; my detached view of physics makes it possible for me to look at things rather objectively.

And this I do in my book, "Aus dem Nichts", in which I have endeavoured to look at our world objectively, and to express my awareness of common elements in everything that presents itself to our perception; for it is undeniable that a great

many phenomena are to be found in all domains. In short, it is my concern to show that the world has its order; and that our brains and our intelligence show certain similarities with "inanimate matter". Similar structures are everywhere perceptible.

In recent times various attempts have been made to bridge the gap between the exact sciences and theological thought. Would it be possible to say that a beginning in resolving this conflict has now been made, and that the exact sciences are now approaching the world of theology?

Binnig: It is, indeed, true that natural science is now moving in the direction of theology; for the purely mechanistic picture of the world that we have developed is no longer valid. Einstein already showed that there is no such thing as "pure space", and we now know from quantum mechanics that there is no such thing as a "pure condition". Today we know that as soon as we observe something, we thereby change it. If I may put it that way, matter has now acquired "human traits".

On the other hand, the theologians have shown little inclination to take account of developments in the natural sciences. But this is something that they should be willing to do, for the natural sciences have

Gerd Binnig was born in 1947 in Frankfurt on the Main, where he studied physics and received his university degrees. From 1978 on he was engaged in scientific research at the IBM research laboratory at Rüschlikon near Zurich. He there, together with Heinrich Rohrer, developed the screen scan microscope. In 1985 and 1986 he worked at Stanford University and at the IBM research centre at San José, California. From 1986 to 1989 he was visiting professor at Stanford University, and since 1987 he has been honorary professor of the University of Munich. He has received numerous scientific prizes, and in 1986, together with Heinrich Rohrer and Ernst Ruska, he received the Nobel prize for physics.

Piper, the publishing house in Munich, recently issued his book, "Aus dem Nichts. Über die Kreativität von Natur und Mensch", a work in which his thinking far transcends the bounds of his own field of research.



given us countless new ideas and discoveries whose assimilation into theological thinking is indispensable. Nevertheless, present-day theology in the broadest sense still clings to old or even obsolete viewpoints; it is not sufficiently progressive. What is needed at the present time is a more open-minded attitude with regard to new scientific developments and research.

Moreover, the same thing could also be said about the philosophers. They, too, limp behind the scientists and have contributed virtually nothing to the creation of a new world picture and a new view of life; more particularly, they have failed to give an answer to fundamental existential questions in the light of the epoch-making results of modern scientific research, such questions as, Who am I? What is my position in the world? In this realm very little has changed since the Greeks of classical antiquity. On the other hand, the natural sciences have changed tremendously. May we look to the physicists for the answers to these questions?

Binnig: No, it is rather the task of philosophy to answer such existential questions. It is, to be sure, true that in recent years the physicists and not the philosophers have been the people who have often provided the models for further discussion in this field. But here it is the philosophers who should take the lead. The fact that they have not done so is to be explained, among other things, by their extreme reluctance to take any risks; the possibility that they might make mistakes causes them to shrink away from anything of the sort. And so these models for further discussion do not develop.

As I see it, thinking is a kind of evolution in which mutations lead to natural selection, all this taking place within the framework of a fractal structure. What I mean by fractal is that each structure is embedded within a larger one; electrons within atoms, atoms within molecules, molecules within living cells, cells within organs, the organs within living beings, which, in turn, are embedded within a group or a society.

Even mistakes have a fractal structure. For example, one can make a slight error in one's reasoning and then, by a process of elimination, ascertain precisely where this error is to be found. One can also develop an entire theory which appears to be perfectly coherent within itself, and then later discover that this theory makes no sense and cannot be put into context with other theories. In other words, in such a case we are confronted with an error of large dimensions, in which smaller errors are embedded. And we must come to grips with this error, as the possibility of evolution depends on this.

However, at the present time, philosophers are not prepared to do this; at least, that is my impression. Present-day philosophy likes to give us nebulous concepts in which the desire to insure oneself on all sides is perceptible. In practice, what this means is that by not committing oneself to any definite viewpoint one makes no mistakes. It is, of course, true that the man who says nothing and leaves everything open does not expose himself to the danger of making a mistake. But this attitude means the end of philosophy. I would, therefore, welcome a more courageous willingness on the part of philosophers to think in new ways.

With your thinking about matter, as, for example, regarding the question whether even stones and atoms may not have a kind of will, you go back to kindred ideas of past ages. Do you believe, for example, that in our interpretation of the world we could learn something from the mystics of former times?

Binnig: One can always learn from history, and so we can also learn something from the mystics. Moreover, that has already happened. The very fact that the thoughts of the mystics had a great influence on

mankind in their own time means that they still live in one way or another in us. They are a part of our "historical consciousness".

Generally speaking, I am convinced that today, when the natural sciences are again growing together and when the quest for connecting elements is being carried on to an ever increasing extent, we should give more attention to the theories and ideas which have come down to us from the past. It seems to me that here much is concealed that we believe today that we have discovered for the first time, and other things that we are about to discover as something new.

Does this mean that past ages from the ancient philosophers down to the Middle Ages, or even to the Renaissance, had knowledge and insights that we have lost?

Binnig: Undoubtedly. Yet, as I see it, this is a perfectly normal process. One cannot be burdened all the time with the whole corpus of knowledge and thought. The death of that which is old is part of the evolutionary process. Knowledge inherited from the past must finally be lost at one time or another, for death is an essential part of every evolution. But there is a mystery in that at least certain elements of this past knowledge survive in a new form. Where ancient knowledge is documented and still accessible to us, it should be critically evaluated.

In this connection what do you think of the turn toward so-called "holistic theories" that we have seen during the past decade?

Binnig: I attach the greatest importance to these theories and my book belongs to this school of thought. Mankind is now at a stage of its development in which it is beginning to realize that the earth and the

ecological system together with everything in it constitute one whole. Externally this development was accelerated by the growing together of the different means of communication and transport throughout the world. But the human consciousness has not undergone this process at the same pace.

It is true, on the other hand, that the necessity of considering all things as parts of one whole should not mislead us into thinking that we should now concentrate our attention exclusively on this whole. All those methods concerned with detail—and which, in physics for example, have for decades prevailed and proved so successful—retain their validity. Yet, in principle, even when concerned with limited fields of interest, one should never lose sight of the whole.

You have given a convincing image of evolutionary processes and creativity in your picture of the step-by-step structure of a pyramid from inanimate matter up to conscious intelligence. The impression thereby created is of a certain inevitability: the next goal is always already foreseen in the preceding step. Even the step from ordinary to artificial intelligence appears to be potentially present in its basic tendency. To what extent does mankind have the possibility of intervening in the further development of this pyramid?

Binnig: Man intervenes decisively in the further development of this pyramid by setting himself goals. Having a certain conception of the future, he will then, on the basis of his knowledge and information, seek to shape this future. Of course, such conceptions cannot always be realized, as unforeseen elements may intervene. When one attempts to plan very far into the future, difficulties may suddenly arise which endanger the project envisaged. To

give examples, one may say that matter has emerged from space, life from matter, and intelligence from life. But it is infinitely more difficult to prognosticate what may one day emerge from intelligence. I personally am convinced that it will be something altogether extraordinary; yet I would not undertake to make any more detailed prognosis about this.

That would be asking too much of understanding. It is only to a very limited extent and only for a relatively short period of time that we can look into the future. In our daily life we shape our future in many different ways, as, for example, in our meetings with other people. It is seldom that we meet certain people purely by chance. In other words, we shape our future, that is to say, our future. When we wish to meet a certain person, we know beforehand, at least approximately, what the consequences of this meeting will be, whether it will bring something of value or be without consequence. But it is not till the meeting takes place that we can be certain about this. It is only then that we can see whether our mental and psychological condition and that of the other person are such that we can respond to each other in a way that will fulfil our expectations, whether, on the contrary, these expectations will be disappointed. An element of chance is always involved. But one can make the effort to give this element its place in the structure of the whole in terms of probability. This means that developments that appear to be probable will be taken account of as probabilities. It is, however, not possible to determine the future in detail.

One chapter in your book has the title, "Build yourself a pyramid and live there for some time". The emphasis is on the words, "some time". It is your position that one m

leave the pyramid from time to time in order to achieve a detached viewpoint. But is it possible for man to leave the pyramid of evolution, if he himself constitutes a step in this pyramid?

Binnig: This brings up the question of man's free will. Can he break away from the laws of evolution with which his being is bound up? My belief is that he cannot. As a product of this evolution he is subject to its laws, which are deeply rooted in him. He can, however, set himself limited, short-term objectives. In this way, he can create something new, which, though necessarily based on what has gone before, is new nevertheless. Moreover, in doing this he creates new laws, as, for example, in such domains as civic rights and traffic regulations, things which are dependent on man. And now he, too, is subject to the very same laws which he has himself created. Though we cannot leave the great large-scale pyramid of evolution, we are able to detach ourselves from minor evolutions contained within it.

When, as a scientist, I set myself a certain goal that I want to achieve within the next five years, I may succeed during this period of time in concentrating very intensively on this task. Without such concentration nothing can be achieved. Yet it is only for a certain period of time that one concentrates on the matter in hand. Finally the time comes when one must detach oneself from this particular project, as otherwise one becomes imprisoned within the limits of this particular task and is no longer aware of what is happening in the world outside. But a great deal is happening; the world and its problems are constantly changing. It is, therefore, advisable after a period of intense concentration to give one's attention to a subject in some other domain. The idea that one should al-

ways and persistently concentrate on one particular object is fundamentally wrong. I know from my own experience that periods of detachment are equally important. The scientist who is not willing to allow himself pauses of this kind must reckon with harmful consequences; he may very soon sense that his personal evolution has come to an end. No longer does anything new come from him. It is only a certain detachment that makes possible a receptivity to new impressions leading to a new evolutionary process.

If we apply this attitude to the realm of practical politics, would you say that it is here particularly that open-mindedness is lacking and that the protagonists are stuck fast in traditional procedures and ways of thinking?

Binnig: That is unquestionably the case. The politician is completely trapped in the narrow framework of his daily tasks. This is an obstacle to his creativity. Even if other people supply him with information, does he have time to assimilate it? If a politician is lucky, he does occasionally meet people whose thinking is different from his own. But here the question arises whether he is willing to listen to what they have to say. The German President Richard von Weizsäcker provides an admirable example of such willingness. His personal success is not least owing to the fact that he is receptive to the thoughts and opinions of individuals and groups of the most divergent types in this country. He is intuitive and creative, but this would not be possible if he devoted himself exclusively to the fixed, official duties of the presidential office.

If one is to think intuitively and creatively, one must have time to be alone, so that new ideas can ripen to maturity in one's inner being.

Without evolution neither mankind nor any other form of life would exist. Whoever rejects the idea of evolution disavows himself. But, as we now see more and more, evolution may also mean the end of man, for this process is not always beneficial; it can also be harmful. It is for this reason that you plead for an evolution in which humane values would stand in the foreground. What kind of evolution would this be?

Binnig: By a humane evolution I mean an evolution that would be the contrary of narcissistic. All entities in our society must maintain with one another a sound relationship of reciprocity, that is to say, they must be able to communicate. This does not necessarily mean that there must be direct communication between party A and party B; in some cases a third party may assume a mediating role. In the same way, extremist social groups, separated from each other by radical differences of one sort or another and which refuse to enter into direct contact, have the possibility of communicating through third parties. On this basis, which makes it possible for everyone to speak his mind, information may flow throughout the whole extent of a society. Opposed to this is the kind of society that I designate as narcissistic, in which one social group very largely determines what will be the interaction of the group with the external world and abuses its position of power to cut off, or at least, curtail communication with other individuals or groups.

It is not only in societies that this situation is to be found; something analogous can also be seen in individuals. More particularly, when a certain individual discovers that a particular procedure will make it possible for him, say, to earn a great deal of money or to achieve professional success and, therefore, disregards what-

ever scruples or misgivings about it which he may have, we then have a case of abuse of power of this individual against himself. Here, as in a social situation, evolution is of an unhealthy kind in which the whole is lost from sight; a subsystem detaches itself and goes its own way.

Signs of such detachment and alienation resulting from this are today perceptible in various branches of science and technology. It is common knowledge that an easy feeling prevails between, on the one hand, science and technology and, on the other hand, large numbers of people. In particular, there is an attitude of distrust with regard to technology. This situation results, to a very considerable extent, from a lack of communication in both directions. The technologists do not pay proper attention to the fears of large sections of society with regard to certain technical developments, and, on the other hand, many people understand virtually nothing of technology. They only know what is happening, or is expected to happen, in certain fields, but without being able to estimate the potential dangers involved on a basis that would be realistic. This ignorance resulting from lack of communication gives political demagogues a good opportunity to mobilize public opinion in favour of certain narcissistic objectives. Everything that obstructs the general flow of information must, therefore, be avoided. Communication is also a field in which we must be creative.

In your book you compare the present destruction of the environment with the discovery of photosynthesis, and in this connection you write: "When, for example, nature created photosynthesis, this had highly deleterious consequences for the environment. The micro-organisms which began to make use of photosynthesis would all have

stroyed themselves, but for the fact that some of them were able to solve the problem of oxygen. Organisms that were successful in this were able to survive; all the others have died out. With this analogy in mind, we may ask: What will be man's fate? Will man be able to master this problem of the destruction of the environment, or will he die out?

Binnig: I prefer to compare mankind with those cells that have survived. Man, considered as a whole, has shown that it constitutes a system superior to all other biological systems, inasmuch as it has at its disposal mechanisms which other organisms do not possess. When photosynthesis developed, it was shown that some micro-organisms possessed a source of energy which made it possible for them to survive. However, the prevailing conditions were anything but stable. Today people would say that when an ecological system is in this condition everything is lost. Yet life survives despite this lack of stability.

What does all this mean for the situation in which we find ourselves today? It is my conviction that we should study the catastrophes of the past and learn what we can from them. It is undeniable that mankind today is in the process of gradually putting an end to other forms of life. To continue on this path would be criminal irresponsibility. We should, on the contrary, endeavour to live in harmony with nature. We are now called upon to do away with any kind of irresponsibility which would involve the risk of an ecological catastrophe.

On the other hand, we must also consider whether in past ages purely natural processes were not also involved in the extinction of certain forms of life. In order to reach the right conclusions, one must consider these things very carefully. I, therefore, cannot accept sweeping state-

ments according to which a destruction of certain biological species is now taking place, that is without precedent in past history. This is simply not true. And wrong arguments will not be helpful in preventing new catastrophes.

The fact remains that you repeatedly call attention to the question whether human life will continue. The prospects are not good. "Perhaps we shall become superfluous. Should we do something to preclude this possibility?" you ask. But is not the real question: Can we do anything about this?

Binnig: It is entirely possible that one day we may become superfluous. But I would not consider this possibility a catastrophe. If from mankind some higher form of life should develop in which we no longer participate, we would survive in this. Children, too, grow up and outgrow their parents; they are something new. One day the parents must die; yet they live on in their children. Consequently, the thought that mankind in its present state will not last forever does not depress me.

Professor Binnig, from the fact that we are only a tiny speck in an immense universe you draw the conclusion that man is very much less important than he has assumed. But a very different point of view emphasizing the uniqueness of man would also be possible. For although the probability of the existence of life elsewhere in the universe has long been envisaged, the fact remains that hitherto it has not been discovered.

Binnig: That is true, yet this idea of the uniqueness of man has been embodied in religion from ancient times. Here there is nothing new. I personally agree with a growing number of scientists who believe that there is a relatively high probability

that life may exist somewhere in outer space. As recently as twenty or thirty years ago the possibility of this was considered to be exceedingly slight.

Formerly it was also believed that life originated purely by chance. Today we go on the well-founded assumption that we do not owe the origin of life purely to chance, even if chance may have played a certain role in this. I, therefore, consider it entirely possible that chance may structure itself, that it may contain an element of purpose bringing forth evolutionary structures, which make life on other planets possible.

This means that man is by no means the unique being that he stills assumes himself to be. The idea that we may not be the

centre of the universe, that not everything revolves around man, further, that man, in the last analysis, is constructed like a machine, albeit of a very particular kind – these insights are for many people painful and deeply disturbing. We have hitherto had an utterly different conception of ourselves – a more godlike conception, if we may put it that way. We must now accommodate ourselves to this new reality. If it is so difficult for us to do so, this is because our low regard for “inanimate matter”, the level to which we are now reduced. But in reality, so-called “inanimate matter” is not dead; it contains many wonders and much life. We have, therefore, no reason to grieve over the fact that we are a part of it.

English translation by Greeley S.²

SPECTRUM

Psychology

On the Causes of Altruistic Behaviour

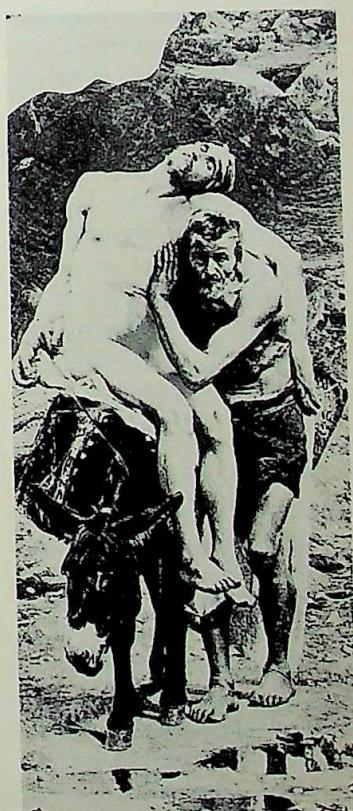
(df). All scientific theories which attempt to explain human behaviour have one basic premise. Man only does things which are good for himself. According to this view, genuinely altruistic behaviour which brings no personal gain must be impossible. Good samaritans who help others must, according to this, have hidden egoistical motives. Recent psychological studies have now examined whether a good deed really does serve the doer.

The psychologist Professor Peter Borkenau, Bielefeld University, writing in the "Psychologische Rundschau" (4/91), emphasizes that he who supports others to ensure their help is only practising „reciprocal“ altruism, which is really egocentric. As there is always the danger that others accept help without repaying it later, evolution has equipped us with strong moral anger against "cheating". However one is more sensitive to offences against fair play in other people than in oneself.

Scientific research shows that the observation of the suffering of others causes unpleasant internal tension, which can be released by helping them. The psychologist emphasizes that altruism would also be basically false if it were only directed towards this "stress

management". The ability to put yourself in the place of others and to feel their suffering "in your own body" is described as "empathy". People frequently react empathetically with the body towards the distress of others. The expression becomes rigid, the electrical conductivity of the skin increases and the pulse rate rises. The experience of empathy is stressful and favours all activity which mitigates the state of excitement. Experimental volunteers faced with a (faked) accident helped the more quickly the more they were internally excited and concerned. Evolutionary biologists consider that this empathetic perception originally served the protection of near relatives, particularly the sexual partner and the children. One was well if they were too.

However Borkenau thinks there may be another basic instinct to help people in trouble which is quite independent of empathy. At least, experimental volunteers who see someone in difficulties can clearly separate these two feelings — discomfort and charitable care — in them-



The good Samaritan who helps others — does he act because of egoistical motives?

(Photo: Ullstein)

selves. If the "nobler" of these two motives actually leads to action, then people should help even without empathetic stress. It has however not (yet) been possible to infer a clear trend from the corresponding experiments. In one study helpfulness was less in volunteers who had been given a drug which allegedly caused excitement. Perhaps they then wrongly interpreted their empathetic stress as a result of the drug — and lost much of their charitable zeal.

He who has helped someone in difficulties finds himself afterwards in a more pleasant mental state. This does not necessarily mean that the purpose of a charitable act is only to improve one's own mood. The fact alone that we are capable of feeling the suffering of others, of sympathizing with them, indicates that, in spite of all scepticism, there exist selfless traits in the nature of man.

However these altruistic features are evidently combined with a certain personality structure, as reported by the psychologist Professor Hans-Werner Bierhoff and his group at the University of Marburg, in the *Journal of Personality* (Vol. 29). To investigate the personality characteristics of these "Good Samaritans" the scientists examined 34 individuals who had unselfishly assisted after traffic accidents, in comparison with 36 "normal" contemporaries. Certain of the personality characteristics of the benefactors were clearly different from those of the control group. They were more "internally" orientated, that is they tended to believe that one's

own fate is decided by oneself, and not by external circumstances. Moreover they had markedly more empathetic sympathy for other people and tended less to put their own interests first. Finally they tended to be characterized by the mental attitude known as the "Belief in the Just World". People with this notion cultivate the illusion that the Universe is fair and that each man gets the fate he deserves. Fortune is always "earned" and the same applies to misfortune. The scientists emphasize that

the observation of the distress of others can shake the foundations of this belief, as it indicates "unjust suffering". Altruistic behaviour then has the purpose of rectifying the justice. However this reaction is not at all a matter of course. You could have thought that the people concerned would have invented bad characteristics for the accident victims as treated them coldheartedly, because "it was all their own fault". Even if it is based on an illusion the belief in a just world can bring out the best in man.

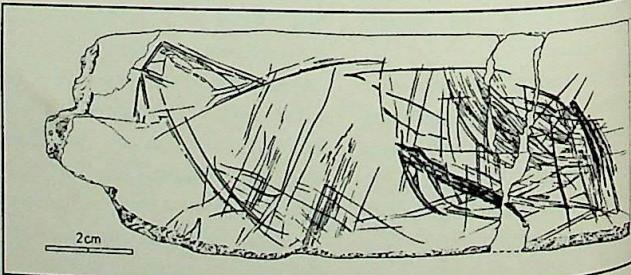
Archaeology

When Did Man Start Painting?

(fwt). When did man produce the first works of art — more than 300 000 years ago or only a bit more than 30 000 years ago? At the present time this controversial question is exciting many prehistorians. It is a question of clarifying whether early man made pictorial representations or whether this was only achieved much later by modern man.

The controversy about the beginnings of painting has been enlivened by two new books, which both describe the development of our forefathers. A collective of authors under the leadership of the Berlin scientists Joachim Hermann and Herbert Ullrich have written a volume entitled "The Beginning of Man" („Menschwurzung“) (Akademie Verlag, Ber-

lin) and in this the first works of art are ascribed to early man of the type *Homo erectus*. In contrast, the Mainz scientist publicist Ernst Probst, in his work "Germany in the Stone Age" („Deutschland in der Steinzeit“) (C. Bertelsmann Verlag, Munich) describes early modern man of the type *Homo sapiens* as the first artist. In the volume "The Beginning



Marks on an animal bone, Bilzingsleben.

(From: H. Ullrich, *The Beginning of man*, Berlin, p. 25)

"of Man" certain finds from the roughly 300 000 years old settlement Bilzingsleben in Thuringia play a particularly important role as examples of works of art of early man. These are mostly animal bones with some or many marks of no recognizable meaning. The most sensational discovery is said to be a bone with a pattern of lines in which the Weimar prehistorian Gunter Behm-Blancke claims to have identified the representation of a lion, with mysterious marks. If this is really meant to be a member of the cat family, then it would be the earliest picture of an animal in the world.

Lines scratched on animal bones found in Vérteszöllös in Hungary are about as old as these alleged works of art. The vertebra of an elephant with cuts patterned like rays, found in Stránska skála in Czechoslovakia, is even twice as old, namely about 700 000 years. In contrast to the spectacular interpretations of Behm-Blancke and of some other East German prehistorians the earliest works of art are dated in the book "Germany in the Stone Age" as being from the time of the first modern men in Europe, somewhat more than 30 000 years ago. Among these are animal and human figures carved in mammoth ivory, found in the caves of southern Germany and of astonishing beauty. These show the mammoth, the bison, the wild horse, the cave bear and the lion, also a praying man with raised hands and a mysterious hybrid creature with human and animal characteristics, which presumably embodies a god.



Head of a lion carved in mammoth ivory from about 32 000 years ago.

(From: G. Behm-Blancke, Germany in the Stone Age, Munich, p. 81)

Stone Age expert Ernst Probst is of the opinion that the alleged works of art from 300 000 years and more ago, found in Bilzingsleben and elsewhere, are just traces of cuts, as arise for instance from the portioning of meat on a board. He believes that the alleged lion and the putative signs — such as grid,

square, triangle, half-bow — of Bilzingsleben are nothing else but the tangle of lines seen on the breakfast chopping board of today, in which a little phantasy allows you to make out many a pattern.

According to Probst, early man had already mastered the construction of tools and weapons from stone, bone and antlers, the building of huts, fire and the hunting of big game. However he did not yet bury his dead, nor did he make music or indulge in any sort of artistic activity. The first hesitant steps in religion, in music and decoration as yet recognized were from the time of the Neander-tals, less than 100 000 years ago. But even they, according to Probst, were no artists.

Brain Research

The Brain Organizes Itself

(df). According to Professor Wolf Singer of the Max Planck Institute for Brain Research in Frankfurt on Main, speaking at a press seminar of the Max Planck Society, the brain more or less organizes itself. For this teamwork the following rule is valid: Only those brain cells remain finally connected which regularly recognize structures together and which evaluate them according to the same criteria, for example lines, colours or looking for movements in the same direction.

In the first months of his life an infant forms a large number of connections between his nerves which are mostly "superfluous". The pathways which are little or never used are destroyed in the years before puberty, in so far as their existence is not justified by regular exchange of data. For example the results are very serious if a childhood corneal opacity is operated on too late. The patient then remains blind

even though his eyes are capable of seeing, as the developing brain has meanwhile cut off all connections needed for processing visual stimulation. In all, about one third of the neural connections which were initially present are destroyed. The individual steps of the collaboration between the neurones are still largely unknown. No wonder, according to Professor Singer, for "the brain is one of the most complex sys-

tems on our planet". The human brain includes in all about 100 thousand million nerve cells, which are joined to each other through more than a million contact points on the nerve fibres (synapses). Information is communicated within thousandths of a second on a conduction net of one million kilometers in total length. This level of achievement puts every modern technical system in the shade. For example the optic nerve is just two millimeters thick and contains more than one million fibres which are well isolated from each other and which transmit different data. We can also see here why the numbers are so immense. The eye perceives up to 70 pieces of information from each individual point of light. These are transmitted first into the visual cortex and then into the most different regions of the brain. Almost a third of all nerve cells are occupied with the evaluation of visual information.

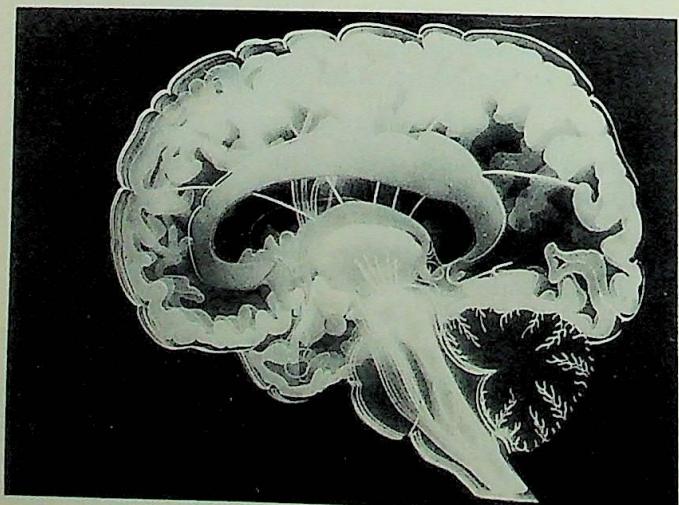
Singer too is working on re-

search into vision, the interaction between the nerves in the composition of a picture from the individual bits of information provided by the eyes. Among other things, he and his colleagues have found out that thousands of nerve cells work together for this purpose. Moreover this principle is also valid for the total cerebral cortex, the site of human intelligence. 40 Million nerve cells connect themselves each time with up to 10 million other cells, forming quite distinct "teams" which can then build a conclusive picture of the environment.

Professor Heinrich Betz, of the same institute, is examining how nerve cells communicate with each other. Data in the nervous system is transmitted not only by electrical signals but also by chemical messengers, the so-called neurotransmitters. Through the synapses these can excite or inhibit neighbouring cells — a principle on which all of computer technology is based. Even the most

efficient calculator is inferior to the brain by orders of magnitude and is solely based on enormous number of switches of which the elements can be turned "on" or "off" as desired and which then embody the elementary unit of information the bit. Neurotransmitters, such amino acids or neuropeptides can pass the connecting synapse in only one direction. They dock at the suitable receptor in the neighbouring cell causing the influx of negative charged chloride ions. Depending on the amount of charge the cell can be inhibited or excited, within fractions of a second. What is more, this knowledge has allowed the clarification of the cause of spastic muscle cramp disease in the mouse. There are too few inhibitory nerve cells in the spinal chord. The result is a permanent overexcitability, leading to collapse.

According to Betz, the synapses do not only transmit nerve signals; they also store them. Switchings which are used frequently are reinforced; those used rarely are dampened. It is possible that the increasingly "canalized" connections store experiences. An argument for this view is that habituation effects can be exactly defined, even as molecular changes. Intoxicants such as mescaline bind to the synapses. These poisons then block the reporting effect which allows the transmitting cell to learn if its signal has been successful or not. As a result of this information the neighbouring cell is not switched off, but excited again and again.



Model of a human brain.

(Photo: Ullstein)

Astronomy

Is the Universe Twice as Old as We Thought?

(fwt). At the beginning there was the big bang, an enormous explosion, which produced all the matter in the Universe out of pure energy. As the dense, hot gases spread out and cooled down they coagulated to a sort of foam, which is still spreading out in space. In this way many astrophysicists picture the birth of our Universe with its stars and galaxies 15 thousand million years ago. Two Bonn scientists hope to explain the origin of the Universe better with a new cosmological model. This would at once double the estimated age of the Universe.

Astronomers have known for some years that the mist of stars which they observed with telescopes or in radio-observatories is not uniformly distributed in space. From the earth out they appear to be concentrated along lines which traverse the sky like a giant net. The researchers assume that they are distributed in space like the walls of enormous connected bubbles.

The Bonn astrophysicists Josef Hoell and Wolfgang Priester believe that the distribution of hydrogen in the Universe is similar. They have reached this conclusion by examining the light from very distant quasars. For the spectrum of light from these "quasi-stellar" structures at the fringe of the Universe exhibits a whole series of more or less regular gaps, which indicate that the light passed through and was absorbed by hydrogen on many occasions on its million year long journey through space to the earth. Not all of the gaps in the spectrum are in the same region. The further a star or quasar is from the earth, the greater the red component in its light. Physicists have long concluded this from the observation that the heavenly bodies are moving

away from us and that the Universe is expanding. According to this view, gaps in the far red region of the spectrum were due to absorption by ancient and very distant hydrogen. A study of all the gaps in light from ancient quasars allows the conclusion that there are enormous bubbles of hydrogen through which the radiation must pass on its thousand million year journey to the earth.

However the Bonn astrophysicists go further. At a meeting in Potsdam in November last year they put forward a new mathematical model which could provide a better explanation for the mysterious "foamy" structure of space. For this they employed a concept which Albert Einstein used in the original formulation of his cosmological equations — the cosmological constant. This section of the formulae, which it is quite impossible to visualize, is supposed to describe the "curvature of space-time" without the influence of gravitation. Wolfgang Priester, Professor for Astrophysics at the University of Bonn, states that his proposals are based solely on a strict application of Einstein's 1917 equations. "It is high time

that these equations were finally taken seriously. It was rigorously proved at the start of the seventies that they were correct, together with the cosmological constant."

Small Value with Large Consequences

Not only many astrophysicists of today, but even Albert Einstein himself, believed it was possible to neglect this constant. "That was a mistake and even someone like Einstein made mistakes", says Priester. "In any case, there was no possibility at that time of determining this constant." But even today many of his colleagues "couldn't do anything reasonable with it". In our immediate vicinity it is of no significance. The situation is totally different when we are talking about distances of the order of more than five thousand million light years. Priester and Hoell give the constant the unimaginably small value of 3 times 10 to the power of minus 56 (a number with 55 zeros behind the decimal point). This allows a much better explanation than previously of the foamy structure of the Universe. The result of a new model would be that the first moment of the Universe would be very much less dramatic than has been assumed till now. There would be a tiny (on a cosmic scale) but adequate interval of some hundreds of thousands of years in which, according to their calculation, bubble-like structures would have to be formed. The theoretical size of the hydrogen bubbles calculated from the model seems to show that the

Bonn researchers are right. They agree well with the measured diameter of about 100 million light years.

Big Jump Instead of Big Bang

However a secondary result of the calculations could be even more important for our picture of the Universe. This would double its estimated age from about 15 to 30 thousand million years. "Many astronomers have been somewhat unhappy for a long time with this estimate, which is based on a back extrapolation from the expansion of the Universe", says Priester. It was simply too close to the age of the oldest star. Many astrophysicists found it difficult to imagine how matter could have

cooled enough in the short time which, according to the previous estimate, was available to it.

Priester's collaborator Hans-Joachim Blome goes even further in the interpretation of similar mathematical models. According to him, matter in the Universe has indeed a definite age, but space and time did not start at the moment of the big bang. The Universe itself has existed eternally and contracted slowly because of its internal properties. It was not composed of matter, but of pure energy. The big bang, which is so difficult for scientists to explain, would then be replaced by an admittedly explosive, but much more gentle, big swing.

Neuroinformation Science

A New Prototype of Computer Recognizes Faces

(saw). The computer hardly needs half a minute to recognize the man in front of the video camera — and it does not let itself be misled by his nervous sideways glances. A computer which is capable of these feats and which can therefore be used as an electronic porter has now been developed at the Ruhr University in Bochum.

Rolf P. Würz of the Department of Neuroinformation Science at the Ruhr University in Bochum explains that, "This computer recognizes faces, even for example from different directions or with different expressions". "Intelligent" neuronal networks which mimic nature in their way of processing information permit this recognition. They are similar to the way in which human nerve cells in the brain function. The 32 microprocessors of the electronic porter are programmed

to use such a neuronal network each, which allows them to solve demanding problems. For example, if someone in front of the video camera turns his head to one side then not all the details in the "eye" of the computer agree with the internally stored frontal picture. The neuronal network then attempts to find typical characteristics in the picture again. If this is successful within the prescribed accuracy then the person is identified and may enter. The reliability of this "trans-

puter based parallel calculator" is at the moment 90 per cent, which means that nine out of ten people who are allowed entrance are correctly recognized at the first attempt. The Bochum information scientists tested the system by getting experimental subjects to go in front of a video camera. The pictures taken were subdivided into individual points and each of these was given a characteristic coding. The unusual property of these codings is that they change only slightly when the direction or expression changed. These are then fed into a data bank in coded form and are then available to the electronic porter as a picture archive which he can consult at an instant with the help of the neuronal networks. Checking faces with machine vision is based on the rapid processing of a large number of pieces of information. This would be quite impossible with conventional computers. The Bochum information scientists, lead by Professor Christoph von der Malsburg, therefore used a so-called parallel computer. In this sort of computer the microprocessors work as it were hand in hand, comparable to a team of mechanics in a Formula-1 car race who can change a wheel in seconds during a stop in the pits. With the electronic porter it is the 32 microprocessors, capable of working like neurons, which form a highly able team. They are connected to each other and therefore work simultaneously on learning or recognition. With the present programming and a data bank of individuals the computer requires about 25 seconds to prove the identity of an employee. At the moment the prototype is expected to produce the mid-term results. The development system is modern and CARE (df). In CARE literally effect of should chance f German yet be tackled Sommer wagon The C CRAL distrib countri The co born b by go CARE mercia packer Ameri after Europe which for A Europe made clothin LOG whole goods

25 seconds to control entrance. According to Würtz this could be improved simply by improving the software. There is the additional possibility of employing further processors. At the moment there is only a prototype of the system, but it is expected that a marketable product will be ready by about the middle of the year.

The development of this new system for recognizing pictures

was supported by the Federal Ministry for Research and Technology. It is also suitable for other applications. According to Würtz it could be used in medical technology, perhaps for the semi-automatic evaluation of microscopic pictures. Its application to robotics could also be interesting; it is often desirable that a robot should recognize a worked part from another direction.

schools, building materials, medical equipment, seed and cattle for breeding. 16 American charities, mostly from the churches, supported CRA-LOG — Council of Relief Agencies Licensed for Operation in Germany. The deliveries came from donations and were mostly distributed without information about the donor or central organization.

In the USA immediately after the war public opinion assumed a "collective guilt" of all Germans for the Second World War and this humanitarian aid helped to prepare the population for the change in American policy towards Germany, which transformed the West Germans within the shortest time from the defeated enemy into the favoured partners in the ideological and political conflicts with the "Eastern Block". To an even greater extent this charitable support from the USA increased the readiness of the West German

Modern History

CARE: A Bridge to Atlantic Partnership

(df). In the years immediately after the Second World War the CARE packets from the USA with high quality food were literally lifesavers for many people. Without belittling the effect of this action and the so-called CRA-LOG deliveries it should also be stressed that they had wider historical significance for the Atlantic partnership between the USA and West Germany which soon developed. This connection has hardly yet been examined by modern historians and is now being tackled by Professor Wolfgang Schäfer and Dr. Karl-Ludwig Sommer of the University of Bremen, supported by the Volkswagen Foundation of Hanover.

The CARE packets and the CRA-LOG relief goods were distributed free in European countries affected by the war. The costs for transport were born by American charities or by government agencies. The CARE deliveries were commercially organized. Private persons bought unwanted food packets from the stores of the American forces and looked after their distribution in Europe. The name CARE — which stands for Cooperative for American Remittances to Europe — was deliberately made public. Apart from food, clothing and drugs, the CRA-LOG deliveries included a whole spectrum of different goods under the motto „Help

for Self-Help“, including furniture, instruction material for



The deliveries included a whole spectrum of different goods under the motto "Help vor Self-Help".
(Photo: Ullstein)

population to accept the "Occupying Forces" as protectors and allies. It was much more effective than the measures brought into bear

under the headings "Denazification" and "Reeducation" and which rapidly acquired the odour of compulsory reeducation.

Pharmaceutical Biology

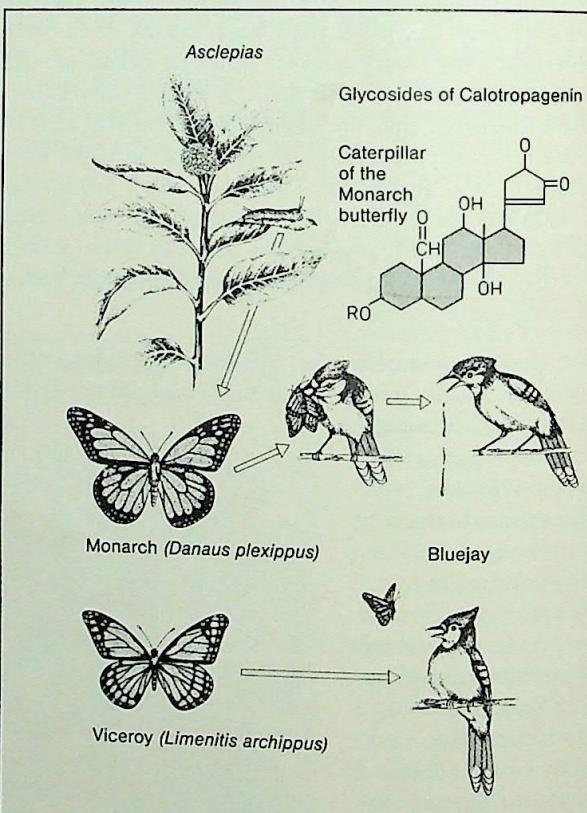
Poison for the Bride

(df). Plants such as lupins, gorse and oleander contain highly poisonous defensive substances which are meant to protect them from being eaten. Nevertheless some specialized insects have succeeded in colonizing plants of this sort in the course of evolution. There are further advantages apart from the exclusive source of food. The poisons protect the insects from being eaten themselves and even act as signals for reproduction.

Therefore situations like this occur again and again. The plant looks as though it had been swept clean. Only a caterpillar nibbles contentedly on its leaves. High in the air a bird espies the potential prey and flies hungrily towards it. However when it recognizes the butterfly caterpillar by its pattern of colouration it turns away — it has remembered its nauseating effect. What spoils its appetite is a poison which comes from the plant.

Among the butterflies and other insects there are specialists which can exploit the chemical defenses of plant for their own purposes. For example, the monarch butterfly (*Danaus plexippus*) has sought out plants which contain cardiac glycosides. These are substances, used at low doses as plant-derived drugs, which influence the ion channels in cardiac muscle and which at higher doses are very poisonous, both to insects and to vertebrates. The butterfly does not only tolerate this poison, but really hoards it. It thus pro-

tects itself from being devoured. As part of their work in the German Research Council's programme on "Chemical Ecology — Natural Substances which Modify Behaviour", Professor Michael Wink and his colleagues in the Department of Pharmaceutical Biology of the University of Heidelberg have examined the problem of how butterflies take up cardiac glycosides and how they can store these substances safely. They have studied the butterfly *Siproeta stemeida epilais*, of which



Cardiac glycosides of *asclepiadaceae* and *danaidae*. On the silk plant *Asclepias curassavica* (bloodflower), the caterpillar of the monarch butterfly (*Danaus plexippus*) matures. Not only the caterpillar, but also the adult butterfly is protected by the cardiac glycosides taken up by the caterpillar with nourishment. Bluejays having no previous experience with *Danaus* vomit after eating a butterfly and then avoid not only *Danaus*, but also such imitators as the viceroy (*Limenitis archippus*).

(Source: D. Hess, Pflanzenphysiologie, [‘Plant Physiology’], Ulmer, Stuttgart, 1988, p.

being in the ncil's Profes his rtment of berberg ha em of b ardiac y can st fe. Th which t larvae live on oleander, and have shown that these larvae specifically take up cardiac glycosides from the intestinal tract — an adaptation which is evidently only developed in butterflies which store cardiac glycosides. The researchers report in the University of Heidelberg "Uni-Spiegel" (5/91) that the larvae and butterflies store the poison particularly in their skin. Like the monarch butterfly they are largely avoided by birds. Other butterfly species too actively take up defensive substances from plants. For instance, larvae of the species *Uresiphita reversalis* eat on plants which contain poisons of the quinolizidine class. These substances occur in many butterfly blossoms, such as lupins, gorse or golden rain. They inhibit the production of proteins in the body of the insect and disturb neuromuscular transmission. In the long term some quinolizidines even alter the genetic material. Caterpillars of the *Uresiphita* butterfly not only specifically absorb these substances from their food and store them in their skin. They also impregnate their cocoons with them. They weave these around themselves before they pupate. The quinolizidines are transferred in this way out of the skin into the threads of the cocoon. Poisons of the pyrrolizidine class occur in three per cent of all plants, are mutagenic and carcinogenic and have their own insect specialists, such as the southeast Asian bear spinner. This sort of butterfly has adapted to such an extent that even its reproductive behaviour is controlled by the poison.

After eating pyrrolizidines the male bear spinners develop large mating organs on the rear of their bodies. These substances are totally normal for them and if the butterflies are not given them their mating organs are really paltry. During display the reproductive parts of the body are expanded and expel a sort of love perfume, a pheromone. It has turned out that these pheromones are made from pyrrolizidines. From a poison, that is supposed to kill, has arisen an aphrodisiac, a substance which stimulates the sex drive. It is even more astonishing that the bear spinner female has developed tailor made receptors on her feelers, the antennae. With the help of these chemoreceptors she can recognize a male of her species and moreover presumably receive information about how attractive he is.

The Heidelberg researchers have evidence that the quantity of poison stored correlates with the quantity of pheromone sprayed. The stronger a male smells the more attractive he is for a female. For both parents (How could it be otherwise?) place this fantastic stuff pyrrolizidine in the cradle of their child — the female by including some of the stored pyrrolizidine in her eggs, the male by storing the substance in his spermatophore, an agglomeration of sperm cells, which are transferred to the female during fertilization. The Heidelberg researchers conclude that it is important for the female to find a partner with as much pyrrolizidine as possible. For the more the male has stored of this, the more he can pass on to his descendants. Like their parents they can grow up in a carefully designed niche made of poison.

Medicine

Does AIDS in the Brain Work Like Scorpion Poison

(fwt). The immune deficiency disease AIDS typically also damages the brain. Virologists of the GSF Research Centre for Environment and Health have now found evidence for the point of attack of the virus. This may be the same as that where scorpion poison acts.

Volker Erfle of the GSF Research Centre in Neuherberg and his colleagues have studied a certain protein which is found in AIDS-infected cells and have shown astonishing similarities with one component of scorpion poison. It was already known how this works as a potent nerve poison, namely that it binds to the so-called

cation channels. These are structures on the surface of some nerve cells which are involved in signal transmission between cells.

The researchers presume that the substance formed during AIDS infection could act similarly. Experiments with artificially formed parts of the HIV protein seem to confirm this. These too bind to the cation channels and disturb their function. In this way an AIDS infection poisons the brain. Similarly in other viral infections, such as polio and rabies, the pathogen binds to important structures on the surfaces of cells.

Medicine

Increase in Cesarean Sections Predicted

Neu-Isenburg (dpa/fwt). In future, more and more children will be born by cesarean section. This prediction was made by Prof. Arthur Wischnik at a symposium on perinatal medicine held recently in Mannheim, according to a report in the *Ärzte Zeitung* (2/26/92).

At the Gynaecological Clinic of the University of Mannheim, the computer tomographs of the pelvises of 500 women of all age levels were analysed. These data revealed that the pelvic inlet of the younger women is

significantly rounder than that of their mothers and grandmothers. This will render natural births difficult in increasing numbers, according to Wischnik. The skeletal changes due to age have no effect on

pelvic dimensions, according to Wischnik, so that the data may be regarded as representative for the various groups.

But how can it be possible that the body structure to change markedly in just a few decades? Wischnik submitted a possible explanation: girls mature at an earlier age nowadays and begin menstruating earlier than previous generations. This means that the pelvis could ossify earlier, thus retaining a more childlike form.

Preview

The next issue of UNIVERSITAS will presumably contain the following contributions:

Transcultural Ethics

World Religions and World Ethos

Hans Küng, Tübingen

Third World

„Catching up on Development“ – a Chance?

Outline of Modern Problems in Development

Dieter Senghaas, Bremen

Politics

Looking Forward to Catastrophe

Politics and the Intellectuals

Kurt Sontheimer, Munich

Philosophy

Evolution and Projection

Approaches to a Modern Epistemology

Gerhard Vollmer, Brunswick

Behavioural Biology

Dangerous security

The Behavioural Biology of Risk

Felix von Cube, Heidelberg

Medicine

Consciousness and the Conquest of Pain

Oriental Wisdom and Scientific Knowledge

Klaus Jork, Frankfurt on the Main

Paleontology

Ecological Catastrophes During

the Earth's History

What is the evidence?

Heinrich Karl Erben, Bonn

Biology

Evolution – Brain – Consciousness

The Evolution of Human Consciousness

Franz M. Wuketits, Vienna/Austria

World Religions and World Ethos

Hans Küng, Tübingen

The followers of the different world religions usually know only too well in what respects their practice does not agree. Unfortunately, they have no conception of what they have in common, above all in the realm of ethics. On the basis of the relevant documents it is, therefore, imperative to find out what are the principles that unite all the great religions. From a sense of responsibility we are confronted with the question: What can these religions do, notwithstanding the differences in their dogmatic and symbolic systems, to develop and support an ethos that distinguishes them from philosophy, political pragmatism and philanthropic activity of whatever kind?

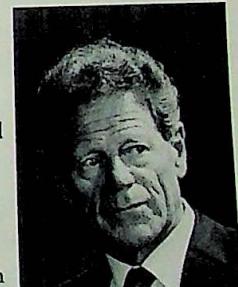
Human well-being

Religions have always been subject to the temptation simply to revolve around themselves in order to maintain the power of their institutions, constitutions, and hierarchies. And yet, when they have the desire to do so, they have the capacity, with a moral strength different in kind from that of many international organizations, to convince the world that they are concerned with human well-being. For all the great religions have the authority to provide us with basic religious guidance and support, to give us help and hope when we are confronted with the internal mechanism of all human

institutions, the egoism of different individuals and groups, and the superabundance of information through the media.

Whoever in the tradition of the prophets truly believes in God, should, in accordance with this belief, be concerned with human well-being. Consequently we have in Judaism the twofold commandment to love God and one's neighbour,

Professor Hans Küng was born in Sursee, Switzerland in 1928. From 1948 to 1955 he studied philosophy and theology at the papal university Gregoriana in Rome. He was ordained in 1954, and then in 1955 studied in Paris at the Sorbonne and the Catholic Institute. In 1957 he received his doctorate in theology. From 1957 to 1959 he served in the ministry at the court church in Lucerne. In 1960 he received a call to the university of Tübingen as professor of apologetics, and in 1962 was nominated official theological counsellor by the Pope. From 1963 he was professor of dogmatic and ecumenical theology, and director of the Institute for Ecumenical Research; and since 1980, independent of the faculty, he has continued as professor of ecumenical theology and director of this institute.



Professor Hans Küng,
Waldbäuer Straße 23, 7400 Tübingen/Germany

carried in Jesus' Sermon on the Mount to radical extreme in the commandment to love one's enemies. And in the Koran one finds a constant demand for justice, honesty and good works. The Buddhist doctrine of the overcoming of human suffering should also be mentioned; likewise the Hindu striving to achieve "dharma" and Confucius' requirement to preserve the cosmic order and with it the realm of human values. In all these religions the well-being and dignity of man is proclaimed as the basic principle and aim of human endeavour; moreover, this ethos is proclaimed with an unconditional authority such as only religion can possess. More particularly, we are here concerned with the life, integrity, freedom and solidarity of man. The dignity of man, his freedom and his rights are not simply matters to be settled by regulation on positivistic principles: they have a depth that is ultimately grounded in religion.

Maxims of Basic Humanity

It is true that religions have always been

subject to the temptation to fix up nature, certain traditions, mysterious dogmatism and prescribed rituals, thereby cutting themselves off from the external world conditions. The fact remains that when they have the desire to do so, they can bring out the essential significance of basic principles, the humanity with an authority and power of conviction which politicians, jurists, statesmen and philosophers do not possess. For all such great religions proclaim certain "universally negotiable standards"; basic ethical principles and maxims of conduct, which are grounded in the Absolute and Unconditioned and which, therefore, are judgeable to be valid for hundreds of millions of human beings.

Five great commandments of humanity, commandments which have innumerable applications not only in the personal sphere but also in economics and politics, are to be found in all the great world religions. They are the commandments: (1) not to kill; (2) not to lie; (3) not to steal; (4) to refrain from fornication; (5) to honour one's parents and love one's children. These principles are of a general nature, in question on the liable norms while, should what good the action, particularly come this p only propo



Christian theologians and Jewish scholars discussing the interpretation of the Holy Bible.

(Photo: Archiv für Kunst und Geschichte, Berlin)

fix upon nature, but let us make a specific application. Consider, for example, what a radical cultural transformation would take place in conditions throughout the world, if the commandment, "Thou shalt not steal", were to enter into the general consciousness and to be applied to the evil of corruption, now ever increasing even in estates hitherto untarnished by this evil. Such norms, unconditionally valid, provide a barrier against a libertinism that considers and lives only in the present moment and situation. It is, to be sure, equally true that such norms should not be put into practice in the spirit of a narrow-minded legalism which clings to the letter of the law without taking into consideration the concrete situation in question. Such difficult and complex questions as contraception, abortion and euthanasia cannot be settled simply by referring to the Bible or some other holy book.

Ethics cannot be properly understood in either theoretical or tactical terms. Neither the legal aspect nor the concrete situation can by itself determine what is right. Norms without reference to the situation in question are devoid of meaning; and, on the other hand, the situation is unintelligible without the norm. Further, the norms should elucidate the situation, while, at the same time, the situation should make it possible to determine what the norms should be. That which is good and moral is, therefore, not simply the abstract good and right, but rather what is concretely good and right, that is to say, what is appropriate in a given situation. In other words, it is only in a particular situation that the obligation becomes concrete. On the other hand, in this particular situation, which, of course, only the person directly concerned can properly judge, the obligation can be altogether unconditional. What this means is

that our duty is always in the context of a particular situation, yet in this situation our duty can be categorical and without qualification. In every concrete moral decision, the general normative constant must be brought into relation with the variable of the particular situation in question.

The Reasonable Middle Way

It is true that religions have always been subject to the temptation to insist on the letter of certain extreme positions, in individual as in social ethics, in sexual as in business and political ethics. And yet, when they are willing to do so, these religions can win the support of hundreds of millions of human beings on this earth for a reasonable middle way between libertinism and legalism. For all the great religions provide models of behaviour which point to a middle way, and this is something very important in view of the complexity of individual and collective dispositions, emotions and interests.

To be more specific, there is a middle way between a greed for material possessions and a contempt for such possessions, as likewise between hedonism and asceticism, between sensuality and hostility to the flesh, between surrender to the world and its negation. Consider the socio-cultural duties which structure the entire life of a Hindu, or Buddhist tranquillity with regard to the world, or the wisdom of Confucius, or the commandments of the Torah and the Talmud, which before God set forth man's duties in the world, or the preaching, neither legalistic nor ascetic, of Jesus, or the many reasonable directives in the Koran with reference to the demands of everyday life. All these religions call for behaviour imbued with a sense of responsibility both



Confucius (in the middle), Chinese philosopher and founder of a religion.

(Photo: Archiv für Kunst und Geschichte, Berlin)

towards oneself and the external world. Going beyond "rules of the game" all these religions also call for certain predispositions, attitudes and virtues which can direct human behaviour *from within* in a way that goes beyond what mere legal regulations can do. In the social situation in which we find ourselves today, this reasonable intermediate position would mean, among other things, finding a way between blind rationalism and maudlin irrationalism, between, on the one hand, an unduly credulous faith in science and, on the other hand, a denigration of science. With regard to technological developments it would mean a position equidistant from euphoria and hostility; and in the realm of politics it would stand between a purely formal democracy and a totalitarian people's democracy.

The Golden Rule

It is true that religions have always been exposed to the danger of getting bogged down in an endless thicket of commandments and prescriptions, of rules and regulations. And yet, when they are willing

to do so, they can substantiate the universal validity of their norms as something categorical and not simply applicable from case to case; moreover, they can do this with a kind of authority that philosophy does not have. Religion provides man with the highest standards in matters of conscience, that categorical imperative of such supreme importance for present day society, which lays an obligation upon us of a depth and fundamental nature that can come from no other source. For it is the fact that all the great religions call for something like a Golden Rule, a norm which, far from being purely hypothetical and conditional, is categorical, apodictic and unconditional, and yet at the same time practicable in the highly complex situations in which both individuals and groups are often obliged to act.

This Golden Rule is already to be found in Confucius, (ca. 551 to 489 B.C.) "What you do not want done to yourself, do not do to others". It is also to be found in Judaism: "Do not to others what you would not have them do to you." (Rabbi Hillel, 60 B.C. to 10 A.D.) Finally we find it in Christianity: "Whatever ye would that men should do to you, do ye even so to them." Kant's categorical imperative could be understood as a modernization, rationalization and secularization of this Golden Rule. "Act so that the maxim of your will could at times be valid as a principle of universal legislation," or again, "Act so that you treat humanity both in your own person and in the person of everyone else as an end and never simply as a means".

It is true that religions have always been subject to the temptation to command in an authoritarian manner, to call for blind obedience, and even to do violence to the conscience. And yet, when they are willing to do so, they can do

provide a singularly convincing ethical motivation. For, confronted as they are today with so much frustration, lethargy and apathy particularly in the younger generation, by drawing on ancient tradition they can provide motivations for action in a form appropriate to the present day; thus they can do not simply by having recourse to the eternal ideas, abstract principles and general norms of philosophy, but by presenting a new attitude towards life and a new style of living in calling attention to embodiments of these ideals.

In saying this, we have in mind the fact that by their life and their teachings the great leading figures of the world's religions, Buddha, Christ, Confucius, Lao-tse and Mohammed, have down to the present day never lost their motivating force as models of life for emulation. Knowledge of the good and of its norms, models and symbols is imparted only once to the individual in a social context. And there is a vast difference between simply giving people abstract lectures about a new style of living and, on the other hand, inviting them to participate in this style of living by giving them a particular example to emulate, whether it be Buddha, Christ, Confucius, Lao-tse or the Prophet Mohammed.

Spiritual Horizons and Ultimate Objectives

It is true that religions have always been subject to the temptation to preach to others about the claims of right ethics, without themselves having first behaved in accordance with these claims in a proper spirit of self-criticism. And yet, if they only had the will to do so, these religions, even today, could still with credibility — some people would prefer to say

could once again — through their teaching, ethos and ritual point the way in this world to spiritual horizons and ultimate objectives; taking a stand against emptiness and senselessness, they have the capacity, with a unique power of conviction, to render this service to hundreds of millions of mankind.

All religions provide an answer to the question of the meaning of the whole, of life and of history in terms of an ultimate reality which makes itself felt here and now — whether it be conceived as resurrection (Judaism), eternal life (Christianity), paradise (Islam), "moksha" (Hinduism), "nirvana" (Buddhism), or immortality (Taoism). Religion can help and guide people who have experienced frustration, suffering and failure; this it can do both by revealing perspectives that transcend death and by giving meaning to their life here and now, and not least in cases where moral actions were not crowned with success.

Criteria of Evaluation and Differentiation

If a common world ethos is to come into being, not only is a large general cooperation between believers and non-believers necessary; it is likewise necessary that the different world religions support this objective with a particular sense of commitment. What might result, if all the representatives of the great religions would cease to fan the flames of war, and begin to call for reconciliation and peace between the nations? What might result, if demands for social justice and the conservation of nature were no longer ignored but supported with the force of moral conviction? And what would all this mean for hundreds of millions of mankind on this earth?

Consider, for example, the obligation of voluntary restraint, more precisely, voluntary curtailment of consumption rightly advocated by Hans Jonas, "the obligation to discipline our power and to curtail our pleasures for the sake of the future of humanity." Without the support of the great religions which speak directly to the conscience of man, such obligations will almost certainly not be put into practice by the vast majority of mankind. And other demands will be equally ignored, as, for example, that of the Zurich theologian, Professor Arthur Rich, who has said: "We must retreat from an economy of more and more to an economy of enough." Professor Friedhelm Hengsbach, Frankfurt, has called attention to the fact that it was the ethically motivated political movements, (such as the labour, feminist, ecological and peace movements), which in our century have brought about an ethical transformation of industrial capitalism. Who today would be better qualified than the world religions to mobilize mankind for a world ethos? To mobilize mankind by formulating ethical goals, setting forth basic ideas of morality, and, through both reason and feeling, motivating people in such a way that ethical norms can be experienced in practice?

It is, of course, true that the problems that confront mankind today, ranging from genetic engineering to the international debt crisis, are of such complexity that it is not possible to arrive at scientific, economic, medical or social solutions to these problems directly from ethical norms and principles of whatever kind, to say nothing of directions for specific courses of action. Yet, on the other hand, for human well-being, such principles and norms can and should be brought into the discussion as criteria of

evaluation and differentiation; and they should play a role in the decision reaching. They would, on a rational or religious basis, provide the framework of a common, fundamental ethos for the world, deep, concrete basis for the achievement of human rights.

Global Vices and Virtues

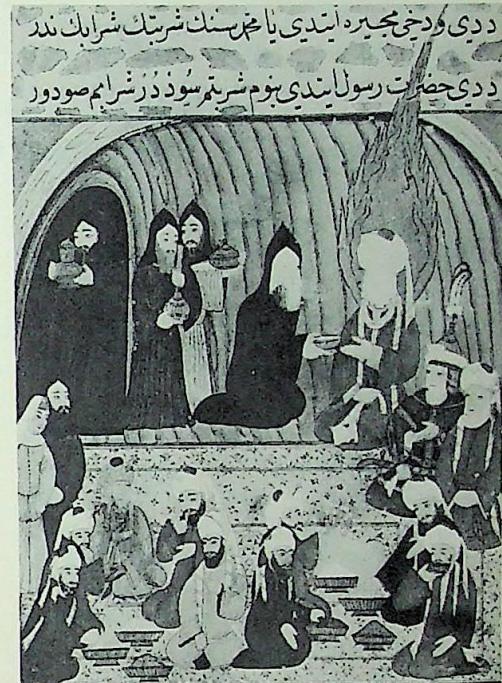
In the complex question of an ethical system that would unite the world's religions, we can here only make preliminary suggestions. As a starting-point it would probably be possible to ascertain that the Christian catalogue of virtues and vices set has parallels, direct or indirect, in all the other religions. For example, in the other religions there are parallels to the seven deadly sins, as they have been called by Gregory the Great: pride, envy, anger, covetousness, lust, gluttony and sloth. Parallels have also been found to the four cardinal virtues of the Greeks; prudence, justice, fortitude and temperance. If, according to the ethical systems of the different world religions, there are whethos that might be called universal sins, and a whole happily, there are also universally esteemed virtues in these religions, why should they not cooperate in combating these sins and in promoting the virtues?

There would be no difficulty in ascertaining that parallels in the different regions can be found. By way of example let us consider Buddhism. It is common knowledge that in this religion self-sacrifice and freedom from envy are highly valued; that, according to its doctrine, the world, though properly esteemed, should not be depleted of its resources; that man should always be regarded as an end, never as a means; that knowledge is worth more than wealth, and wisdom,

more than knowledge; and that affliction should not bring despair. All these basic attitudes have parallels in Christianity, notwithstanding the differences in the general context.

Now let us look at still another religion. The Moslem holds in high esteem a sense of order and the striving after justice; the virtues of courage and composure are particularly important for him; yet at the same time he also prizes patience, humility and solidarity. All these virtues have parallels in Judaism and Christianity.

It goes without saying that the proposed ideal set forth in this article represents an ideal; yet, with the necessary will, the realization of this ideal would be possible. That the reality of all the great world religions often makes a mockery of such ideals is only too well known. In all the world religions, as also in most states, one sees that ideals of human rights have not been adequately achieved; that there is tension, or even conflict, between the deethos of the religion in question and an ethos that would be valid for mankind as a whole. In this connection we could mention the prohibition of contraception in the Roman Catholic Church; the treatment of women, dissidents and non-Moslems in Islamic fundamentalism; and the preservation of the caste system in Hinduism. These matters do, indeed, confront the respective religions with very serious questions, but they do not destroy the validity of the high moral ideals of these religions. It is, however, true that if they are to be credible, the different religions must first themselves take radical measures to put into practice in their own actions the ethical principles which they preach to the world; and they must do this wherever they preach these principles.



Mohammed debating with Christian monks.
(Photo: Archiv für Kunst und Geschichte, Berlin)

In fact, however, we cannot help perceiving that the different religions are today developing a consciousness of their ethical responsibility, a responsibility of global dimensions. In the field of ethics, it has been shown that, in the last analysis, the theoretical terms or reference, different with each religion, are less important than what is actually done or left undone in the practice of everyday life. And, in this practice, men and women of the different religions who are truly religious in the best sense of the word, have always been able to establish contact and to understand one another. This shows that, both in large and small matters, common actions and abstentions are, indeed, possible, however different the theoretical foundations and implications of the various religions may be.

English translation by F. C. Greeley Stahl

Looking Forward to Catastrophe Politics and the Intellectuals

Kurt Sontheimer, Munich

German intellectuals, unlike most people in this country, have seldom felt themselves to be in accord with the German Federal Republic. They feared that the new German democracy, brought about by the occupation, had in its infancy already moved in the wrong direction. With critical eyes they focused their attention on everything that smelt of "restoration", believing that in the policies of our epoch aimed at restoring the old order they could perceive the germs of another abortive development from our new beginning as a democracy.

German intellectuals, (who, at first, were all more or less left-wing, as those on the right had either disappeared or become silent), had an uneasy feeling during the time of Adenauer. They believed that this new beginning should mark a decisive break with the past; that it should be a cleansing, chastening process imbued with a spirit of atonement and radical change, such as Karl Jaspers incessantly called for. Some length of time had to elapse before these intellectuals, that is to say, a considerable number of them, — by no means all — began to understand that the conditions for the development of the Federal Republic now prevailing were so utterly different from those at the time of the Weimar Republic that, without any necessity for the contrition of the Ger-

man people, the Federal Republic could now pursue a course aiming at both economic and political success, while at the same time achieving a very respectable status as a democracy. Yet it was not

Professor Kurt Sontheimer was born in 1928 in Gernsbach, Baden. His university studies in Freiburg (Breisgau), Kansas (USA), Erlangen, and Paris were in the field of history, sociology, and political science.

He received his doctor's degree in 1953, and in 1960 his "habilitation". From 1960 to 1962 he was professor of political science at the College of Education, Osnabrück; and from 1962 to 1969 had the same position at the Otto Suhr Institute of the Free University of Berlin. Since 1969 he has been professor of political science at the Geschwister Scholl Institute of the university of Munich. Among his publications the following are particularly important: *Zeitenwende? – Die Bundesrepublik zwischen alter und alternativer Politik*, Hamburg 1983; *Deutschlands Politische Kultur*, Munich 1990; *Von Deutschlands Republik*, Stuttgart 1991; *Die Adenauer-Ära*, Munich 1991.



Prof. Dr. Kurt Sontheimer, Geschwister-Scholl-Institut für Politische Wissenschaft, Universität München, Ludwigstraße 10, 8000 Munich 22 / Germany

for the intellectuals to accept these facts, for it was with them a fixed idea that they, as intellectuals, had the duty to lecture the politicians.

All this, however, made little impression on the citizens of the Federal Republic. For them the course of development as it continued was, on the whole, very satisfactory, all the more so as, little by little, conditions were steadily improving. It did not disturb them that the intellectuals first denounced their petit bourgeois materialism, and then their alleged indifference to political affairs. With the exception of small minorities, whose behaviour suddenly acquired a radical character, these citizens, by their votes regularly gave the established parties the right and legitimization for political activity in their behalf, thereby giving the lie to the thesis of a "crisis of legitimacy" in the political system that was so effectively propagated in the 1970s by the intellectuals of the New Left. Even if they were not really enthusiastic about their state, it was clear that they wanted "no experiments", and down to the present day they have, on the whole, had little to object to.

blic co
both a
while at
respect
as not

his "hab
professor
ucation
had the
tute of
he has
the Ge
iversity of
following
nde? - D
alternative
s Politisch
ends Repub
ra, Muniz
r-Schall
o,

blik?", 1966, Karl Jaspers, who, however, may be considered a relatively conservative figure among philosophers, believed that he already saw an authoritarian state in the making that would lead to war; in short, it seemed to him that the disaster of the Weimar Republic was being repeated. And why did Jaspers take this view? Because, in his opinion, there had been no real change in 1945; he saw that the political parties were just as they, unfortunately, always are, that is to say, short-sighted, fixated on elections, mediocre, devoid of ideas, opportunist, bogged down in routine, in short, too small-minded for the aspirations of an intellectual aristocrat à la Jaspers.

And then, with the student revolt, the intellectuals of the New Left had their chance. They declared that the present system was basically indefensible, not simply in need of repair; they further proclaimed that they knew precisely what was the cause of the disaster towards which we were hastening or, rather, of which we had become the victims: this, they said, was the advanced stage of capitalism, and they never ceased to proclaim that this economic system contained within itself the worm that would destroy it, or else drive it to fascism. This they proclaimed notwithstanding the fact that the predictions of classical Marxism had not yet been fulfilled. In fact, however, these gloomy forebodings proved to be untrue; the economic and social conditions obtaining in German society and in the world at large were judged in a way that was completely wrong; many people were befuddled in their thinking, yet no revolutionary movements were launched.

The neo-Marxist prophecy of doom, something that even with hindsight it is difficult to understand, has no longer been heard during the past few years; yet,

Looking forward to Catastrophe

We may say, then, that the criticism of the intellectuals has not led to any significant change in the present-day situation. Nor can it be said that society has changed for the better; it seems to be a characteristic of critical controversy in the Federal Republic, whether of the left or of the right, to go too far. It is curious to note that many intellectuals in this country seem to be driven by a sort of pleasurable anticipation of destruction; their gloomy view of approaching catastrophe suggests that the last days of the world are at hand. In his book, "Wohin treibt die Bundesrepu-

on the other hand, with some intellectuals, the gloomy pessimism of a Cassandra did not increase to its present extent until people suddenly began to realize the danger for the whole world arising from the consequences of gigantic, world-wide industrial developments. That was a great new theme that aroused the concern of conservatives and left-wingers alike.

The Terrible Visions of the Critics of Modern Civilization

This theme, conjuring up visions of future catastrophe, provided an excellent argument for use in a searching criticism of modern industrial society, a society based on rationalization and constantly aiming at further growth. In view of the fact that West Germany was the most successful and most dynamic industrial society in Europe, it is no wonder that it was our country that was particularly harassed by the many critics of modern civilization with their terrible visions; it appeared that it was our country that would be most affected by the grievous problems which would inevitably confront us. It is also worth noting that Germany had long been familiar with a tradition of the most radical and uncompromising criticism of modern civilization, a critical tradition averse to any form of pragmatism; this cultural pessimism was already to be seen in Paul de Lagarde and the "Rembrandt Germans" of the nineteenth century.

Arrogant and Categorical

The spiritual atmosphere in which this cult of decadence could develop and flourish was evidently still fertile. It proved to be an error to have believed and hoped, as I had, that the German mind, after all its bad experiences in the twen-

tith century, had liberated itself from the fascination of metaphysics, and escaped from the spell of Hegel, Nietzsche and Spengler. Here there has, unfortunately, been no change. When the German intellectual goes around criticizing conditions which, however tolerable they may be, do not satisfy his very exacting demands, he tends to behave in a way that is arrogant and categorical. A sober analysis of the situation and its inherent dangers is not the thing for him. This is the time to bring up the big guns. Consider, for example, what Hans Magnus Enzensberger said in 1968, taking the view that our condition of the German Federal Republic was irreparable: "The political system of the Federal Republic can no longer be repaired. We must either accept it as it is or else put another system in its place."

Then a choice has to be made; a low-key compromise or intermediate position is ruled out. Happily Enzensberger knows better. Yet the fact remains that too many German intellectuals take pleasure in assuming a dramatic posture and sketching out scenarios of catastrophe. And there are some who combine the picture of the horrible dangers said to be threatening us with an appeal, compounded of emotion and politicizing, that is based on irrational elements.

Intellectual Fashions

Arnulf Baring is quite right when in his book, "Unser neuer Größenwahn", writes: "We like to think in terms of alternatives of ineffable salvation or immeasurable catastrophe, of promising turning points or terrible ends; a shrill cry for about-face implies that the alternative of death and destruction".

Is this not so? Was it not so in the case of whatever recent intellectual fashion

chose to follow? And is this not a constantly recurring phenomenon?

I realize that in making these critical remarks about certain aspects of our political culture I am on slippery ground. Am I not making light of the grave danger to nature and human life resulting from the unbridled development of industrial civilization with its growth fetishism, a danger that is now so evident? Am I not turning a blind eye to the dangers of a nuclear catastrophe? Do I not see that the Creation, entrusted by God to mankind, is slowly but steadily dying as a result of our actions? Is not the necessity of a radical rethinking, of a genuine about-face clear for all to see?

Indeed, I am not minimizing the gravity of these matters in any way. On the other hand, I have little inclination to follow the beaten track with threatening language in the style of such formulations, a kind of language which creates a vague feeling of anxiety but without showing the understanding needed, if measures are to be undertaken. I have no use for the so-called "happenings", oscillating back and forth between enjoyable experiences and feelings of anxiety, that were carried on in such a spectacular way at the time of the German peace movement, both at congresses of the Protestant Church and elsewhere. I have little understanding for the new mania for mythology, and, to speak frankly, I have little confidence in the intellectual competence of colleagues who, in the present crisis of our civilization, look for help from those who profess to hear the mythical spirits of nature.

A Society of Mediocrity

I am inclined to agree with Hans Magnus Enzensberger, who, in a brilliant article

entitled "Mittelmaß und Wahn" has forcefully developed the idea that the way, sometimes verging on madness, in which we thematize our public affairs, together with attendant actions no less mad, indeed, sometimes even carried to the point of terrorism, is simply the dialectical response to a society that is shaped and ruled by mediocrity. "People who predict disaster usually want their prediction to come true; this is equally true of religious and of social prophets. The consequence is that when their prophesies are not fulfilled, this is for them rather like a narcissistic insult. And so they increase the dosage". But all this makes no impression on the broad masses of the people, so firmly entrenched in their mediocrity; they are unflappable. "The social integration of the people of this state has surpassed all expectations. They have been so successful in dealing with previous crises that it would not be too much to say that never before in German history has there been such a high degree of stability as at the present time". Does this, then, mean that we should no longer allow ourselves to become excited, that we should simply sit back and do nothing in the hope that mediocrity, showing that it has reason on its side, will be able to prevail? Should we simply let these eccentric alarmists go on talking, since they make no impression on the masses? By no means!

Custodians of Reason

However mediocre one may consider this society to be, with its ruling majority reaching from the Christian Social Union of Bavaria to the Trade Union of Metal Workers, and even if this society in the words of Enzensberger "wades in mush", it will still not readily do anything that would endanger its vital interests, even if,

in a particular case, it may not know where the danger really lies. Even if the Cassandra cries that enliven our feuilletons, and which our publishers are always so glad to have, pour out with apparently no more effect than raindrops pouring down a waterproof raincoat, it still remains important for this society in critical situations to know what is the right thing for it to do. And, therefore, even in this so remarkably stable society, an informed and critical public opinion is needed for serious deliberation and discussion with a view to learning the truth and deciding what is right. Our society, notwithstanding all its complacency and selfishness, must rely on this in case of need. When the custodians of reason are not at hand, the consequence is that the masses of average people are without information and guidance. Once these masses of worthy citizens lose their self-assurance, a possibility that can never be entirely excluded in view of the outbreaks of mass hysteria in German history, there is no telling what may happen. And therefore, if reason is not to be submerged, it is now necessary to come to grips both with the present German drift towards a new megalomania and also with certain irrationalist movements of today, which, likewise, are characteristically German. These developments cannot remain unchallenged and be allowed to simply run riot, even if they have not yet shaken the stability of our institutions. There is no guarantee regarding future consequences.

The spotted garment of pluralist indifference may be appropriate for the television moderator, but it is not the right thing for the rational intellectual in the German Federal Republic, who should be equally careful not to wear the grey uniform of the dogmatists; in the presence of potentially dangerous currents of

thought, it is his duty, to the best of varying knowledge and belief, to fulfil his responsibility as an intellectual on behalf of the person.

Even if this responsibility of the German intellectual is, in the first instance, for his own country, it goes beyond assuming world-wide proportions and compassing all mankind. We live today in a world that has grown together, a world in which no people and no country exist alone, although there are still many people whose behaviour ignores this

Carry on, Germany!

We should not flatter ourselves because of the generally good state of affairs in the Federal Republic; yet, on the other hand, this is something that should not be denied or belittled. Politics in the states of the world is concerned with the more or less the same thing; first, with mere survival; then, with living; then, with living well, or what the philosophers of classical antiquity called the good. Some people, usually those who have political power, fare better than the many whose conditions of life are determined by the prevailing power structure. It is not much to say that the German Federal public is today one of the richest, freest and the most stable societies in the world. Bavaria and that as a political power, it is not the significant danger either to its neighbour, or to the precarious international balance of power of the Great Powers. Likewise, within our country power is divided; it is not held exclusively by a ruling class or privileged minority, as, for example, monocrats and their political henchmen. The trials of strength in the Federal Republic take place within the framework of a pluralist system, in which there are many different power groups, albeit

varying degrees of strength. In addition to the institution of the state itself, one may mention the political parties, industrialists, trade unions and numerous other organized interest groups, to say nothing of a wide-ranging public opinion. It certainly cannot be said that all these various elements are generally subservient to the holders of power.

There are today few countries in the world where the people, in their majority, enjoy such freedom and prosperity as the citizens of the Federal Republic. It is, therefore, altogether natural that they should be, on the whole, satisfied with conditions resulting from the historical development of this country. Do they not have the right to feel satisfied? When did the people of Germany — admittedly, I mean the majority — ever fare as well as they do today, only about forty years after the establishment of the West German State? Bearing in mind the favourable conditions that prevail, one can, therefore, understand that, on the whole, they have had little desire to indulge in political experiments that might call into question what they have achieved. It is equally understandable that — once again, in their majority — they have had no yearning for a republic of another kind, and that, except in certain areas such as Bavaria, they have shown no desire for the rule of a strong man.

We are a country to which a large number of people from other countries have come, attracted by our fleshpots, but also by the freedom that we have. Their living conditions here are far better than they were in their own country. A great many of them have become, or will become, our fellow-citizens. Our gross national product is steadily growing, even if it is very far from being equally distributed. Insofar as it is possible today to speak of

a German world conquest, this can only refer to certain developments in the sphere of business, trade, and economic relations, unless one also takes into account the particularly striking phenomenon of tourism. On the sunlit beaches of all continents one finds German tourists, who thereby endanger nothing except perhaps their own skin; some of them search out obscure little places all over the world, travelling by motor caravan or by bicycle, as this is said to be more healthy.

In short, Germany is a country in which people can live rather well and with a feeling of security, and a country in which people who desire to do so can enjoy a life full of variety, granted that this statement does not apply to all people to the same extent. If the present rather stolid and phlegmatic leader of our government feels quite comfortable in his position from which he calls to us, "Carry on, Germany!" can we really hold this against him? Is it not a fact that, under similar circumstances, his political opponents, the Social Democrats, were equally fulsome in their praise of Germany as a model state?

These facts can hardly be denied by anyone who seeks to form a balanced judgment of conditions in our country. There is, however, a crucial problem in that a very considerable part of the criticism made by our intellectuals regarding conditions here shows either an unyielding determination simply to ignore these incontrovertible truths, or to minimize their importance, or else simply to take them for granted, an attitude which is even more misleading and reprehensible. In a critical book directed against left-wing criticism of the Federal Republic I have provocatively characterized this phenomenon as "the misery of our intellec-

tuals". Anyone who does not recognize the fact that, judged by internationally valid criteria and even when compared with the western democracies with their political theories of the democratic constitutional state, the German Federal Republic enjoys a high standing, is either hopelessly blind or simply malevolent in his refusal to acknowledge something that is perfectly obvious. If so much of this criticism has so little effect, this is perhaps because these essential facts are not properly recognized.

The Language of Catastrophe

However, the cardinal weakness of this criticism is in its one-sidedness and gross exaggeration, its violation of the principle known in legal terminology as the proportionality of means to ends. The temptation to indulge in vitriolic, grossly exaggerated criticism and protest is nothing new; it is a temptation that is, in fact, always present. It arises from the natural, subjective interest of the critic to throw a glaring light on the object of his criticism, and to make of it an issue of world significance, or at least of decisive importance within the framework of the given political system. This temptation is also to be explained by the belief — a belief which, in the long run, turns out to be a fatal mistake — that only by crudely exaggerated accusations, overshooting the mark, is it possible to provoke a reaction from the competent authorities. There is a feeling that criticism will simply be ignored, unless it is exaggerated and supported by sensational protest. This is, of course, sometimes true; yet, in the long run, the quality of criticism suffers, when it is carried on in this style; such criticism cannot be taken seriously, and is, therefore, unhelpful.

There is no lack of examples of sort of thing. How often has the return of the Weimar Republic been conjured up and likewise the imminent danger of new militarism, nationalism or even socialism! We were constantly being warned against the danger of restorations of kind or another of the German past! And we can still remember how crude and violent the criticisms of conditions of criticism Germany became in 1968, when university students believed that they had uncovered the authoritarian state, a nation that was in emergency and the new German fascism of our day. They even went to the extreme of regarding representative democracy, as their enemy!

This style of vitriolic invective did not disappear with the decline of the student movement, and has, unfortunately, become a part of our political culture. Light was widespread in the movements of new sociology, in which all problems under consideration were said to be centers of life or death for society, and for the world.

In the same way, experienced industrialists and officials of various business organizations today habitually speak in terms of imminent catastrophe, though in most cases what they are worried about is simply the possibility that their profits may turn out to be less than they had hoped. They are constantly haunted by the thought that the industrialized states may be left behind in the world-wide competition for output and efficiency, with the consequence of a decline of the German economy. It is always the old story.

It is true that this deplorable habit of deliberately calculated exaggeration regarding catastrophes to come is limited to critical intellectuals; the phenomenon is often to be seen in

clashes between government and opposition. And today there are even many scientists who speak in the same style, something that is particularly disturbing in view of the fact that scientists profess to serve the truth "and nothing but the truth".

I cannot here go more deeply into the difficult question of the proper function of criticism, but I am convinced that here in Germany we are very far from having had the informed and critical public opinion that would be so helpful in the solution of our problems. If we did have this, and if we did not argue in a manner so unreasoning and devoid of political sense, then our situation, already fairly satisfactory on the whole, would, in many respects, be still better.

Light and Shade

Behind the indisputable fact that, for this country and the majority of its people, conditions are generally satisfactory, there lies a many-sided reality compounded of light and shade. There are many things in the German reality of today that are disturbing and a cause for anxiety, many things that are legitimate objects of criticism; indeed, there are conditions that can only provoke indignation. I can here only mention a few of them.

First of all, while it is true that, for the majority of the citizens of this country, the general state of affairs is satisfactory, this is by no means true for everyone. Consider, for example, certain minorities: the unemployed, the foreigners (including the foreign workers), the people who are here for political asylum, those people who have recently come to us from the East, and the many marginal groups. So much for the minorities. With regard to the majority, it must be said that this ma-

jority includes many individuals and groups who live very well but who do not do their work as well as they could and should. One thinks, first of all, of the political parties, but also of those organized interest groups, who always think only of themselves without regard for anyone else. They are all subject to the temptations of corruption, which is for them a normal and familiar state of affairs, and one that is now so well-known that we are tired of hearing about it. The same thing could be said of the world of the mass media, and the fact is that even the universities are not free of corruption.

For years we have seen people tinkering with our liberal constitutional order, just as previously we were the witnesses of a hallucinatory terrorism which has been judged very leniently by some people in this country who want new policies. Some former Nazis have received better treatment than their innocent victims! We have continually praised the police, even when policemen went too far. We have not prevented radio and television, which within the framework of their status under public law were very well constituted, from coming under the control of politicians and private interests which are without high standards or any interest in the diversity of public opinion. What they want is the production of standardized programmes that are profitable to themselves, even if without any real cultural value.

This list is neither complete nor systematic; its purpose is simply to put our generally favourable picture of the German Federal Republic in proper perspective by calling attention to the countless deficiencies, weaknesses, cases of injustice, and absurd inconsistencies from which we, and even more the world around us, suffer. It is our duty to criti-

cize these conditions and to undertake the necessary reforms; for if we deserve credit for the things that are right and good, we must at the same time accept responsibility for what is wrong and indefensible.

"Everyone wanted what was best – for himself"

Regarding our country, what this means is that even if the Federal Republic is, on the whole, a pleasant country where one can live tolerably well, this fact gives us no excuse for doing nothing in the smaller sphere of our daily life, where it is incumbent on us to discharge our duties as citizens and members of society.

By this smaller sphere I mean the area of life in which we could exercise our influence. This includes our daily work, life with our family and with other people, and many other things. I am also thinking of the political parties, which, with all their thriving activity, have so little to offer intellectually; of the unwillingness to help one's fellow men in a spirit of solidarity; of the lack of consideration for the environment. I refer to the attitude which Siegfried Lenz so aptly characterized in the following words: "A tombstone for this time might well carry the inscription: Everyone wanted what was best – for himself".

We have in the German Federal Republic a good constitutional order, a pluralist

democracy that respects human rights. This makes it possible for us to present what we have achieved – that is to say, prosperity, security, freedom, the quality of life – and to see to it that these things continue to flourish. It also makes it possible for us, whenever we have the desire to do so, to criticize and protest about conditions that are not as they should be, even if it will never be possible to put an end to these conditions altogether.

Horst Krüger, a German author who is reading, someone who knows the world and to whom everything unpolitical particularly foreign, drives over the Rhine bridge between Strasbourg and Kehl, crossing the border back to Germany in his car. He describes what his feelings are.

"Once I have crossed the border, I have the feeling that in the Federal Republic I am no longer a foreigner. The eagle of the country no longer alarms me as it did in the past. It speaks to me in a quiet, serious manner: 'Please, this is where your country begins'. At first I agree, even if without any overpowering feelings of happiness or pride. O.K., all right. That is quite true; this is where I am at home. This is my country. And I say that honesty requires admitting that this is true. This is a country where one can live, and not at all badly. It is not a matter of course for a German intellectual to feel at home in Germany."

And sometimes I ask myself how long this condition will last. Germany has not usually been a free country; the present freedom is most an exception in our history".

English translation by F. C. Greeley

"Catching up on Development" – a Chance?

Outline of Modern Problems in Development

Dieter Senghaas, Bremen

Particularly in the last forty years both national and international organizations and scientific investigators have been occupied with the problems of development. The concept of "developed" or "undeveloped" countries was at first only rarely mentioned, and in fact the expression "developing countries" only became current after World War II. This is a surprising observation, as the modern problems of development are much older than this. They can be traced back to the 18th century, when there was a historically unique drive towards modernization in agricultural and industrial production in England. Since then there has been the problem of "catching up on development".

The modern problems of development arise when there is a differential in knowledge and organizational ability between two economies which actively trade with each other, or when such a differential develops as a result of the uneven dispersion of technological or organizational innovations. It then happens that a less productive economy is faced with a more productive; a difference in competence exists between them. If trade is then maintained there will be a direct competition between the more and the less developed economies to win a place in the market. The dominant society or economy will then easily be able to sell its pro-

ducts cheaply, both nationally and internationally, as they have been produced with modern technology and high pro-

Professor Dieter Senghaas, born in 1940 in Geislingen. 1960 to 1967 studied sociology, political science, history, philosophy and Romance languages in Tübingen, Frankfurt on the M. and in the USA. 1967 Doctorate at the University of Frankfurt. 1968 to 1970 Harvard University, Cambridge/USA. 1970 to 1978 Head of a research group at the Hessen Foundation for Peace and Conflict Research. 1973 to 1978 Professor for International Relationships at the University of Frankfurt. Since 1978 Professor at Bremen University. Numerous publications on key issues and methodical aspects of peace research, among others: Europe 2000. A Plan for Peace (Europa 2000. Ein Friedensplan), 1990; Conflict Formations in the International System (Konfliktformationen im internationalen System), 1988; The Future of Europe (Die Zukunft Europas), 1986; Europe's Development and the Third World (Europas Entwicklung und die Dritte Welt), 1986; The European Experience (Von Europa lernen), 1982; Deterrence and Peace (Abschreckung und Frieden), 1981, 3d Edition.



Prof. Dr. Dieter Senghaas, Freiligrathstrasse 6,
2800 Bremen 1/Germany

ductivity. If there are no protective barriers, the goods produced with out-of-date technology and low productivity in the less developed society will simply be out-competed. Moreover, if the difference in competence between the more and the less developed economies is particularly large, then the necessary effort in the less developed society to make this good is often discouraged from the start. With such stragglers in development the readiness to achieve or to innovate may dry up completely, as the more competent leading economy can exploit its superiority in every way — in relation to the techniques of production, the products themselves or the ability to innovate continuously. To some extent, an economy which has managed breakthroughs in important areas of technology and products can and knows everything better already. Competition for a place in the market is thus a rather comprehensive phenomenon: It is not only a question of products which are cheap due to higher competitiveness. Societies which are exposed to a competence differential are, in the open world economy, often forced aside on a wide front. As the phrase now is in discussions of development, they are marginalized or peripherized. If they succumb to a broad peripherization pressure there either takes place a decay in traditional ways of life, to social regression; then they are simply overwhelmed from outside. Or they are restructured to appendages or enclave economies of more highly developed societies. The history of such peripheral societies shows that this effect is often helped to come about by political pressure or even superior military force.

In the second case, the restructuring and loss of independence of societies and their conversion to appendages or enclave economies of more developed societies,

there arise, from the point of view of dominant economy, exclaves such as monoculture or plantation economies. These a few goods, such as sugar, tea, but also mineral products, are produced for the market of the more advanced economy. Such enclave economies have also fragmented structures, in which no broad and broadly effective potential is developed. Admittedly, when there is a demand from rapidly industrializing advanced societies for agricultural products and for unprocessed raw materials, can be considerable growth in the corresponding exclaves in the less developed economies. However the result is only short lived and specious, forers in enclave economies are usually split between an outwardly directed growth and a relatively stagnant economy. If the demand for agricultural goods and raw materials drops as a result of changes in the trade cycle and/or structural alterations in the leading economies — and this has always happened international economic crises — then only does the externally led growth the corresponding sector collapse, so the scanty linkages of this growth to rest of the economy. The affected society is then thrown back to a self-supporting economy, usually at a wretched level.

Universal Problems

The modern history of development shows that the processes I have described have not only been observed in the relationship between industrializing Europe and the rest of the world, but also in Europe, where in the 19th and 20th centuries there were regions with comprehensive breakthroughs in development but also large areas, such as southern and eastern Europe, where pressures on

view of market, predominantly from the industrial centres in north-west Europe, led to real peripherization. The problems described are thus really universal; they have also affected Europe, their own place of origin.

Beat Them with Their Own Weapons

Now you could imagine quite a different reaction to the developing competence differential. The pressure on the market towards peripherization which I have described could also be seen as a challenge which could be countered by deliberate measures. The gap between the leaders in development and the stragglers would then be seen by the latter as an opportunity. Imitation, appropriate protective measures and carefully directed agricultural projects should cause the lead in agriculture to be reduced or even removed. The political slogan for development is then: Catch up or even overtake! This would then be an active and innovative response to market pressure and the growth trend to peripherization, totally in contrast to being passively overwhelmed by growth from outside or to restructuring to a monocultural and subordinate economy based on the needs of the dominant society for agricultural goods and raw materials. The precondition for a constructive reaction is though that the gap between leader and straggler be not too large and some of the prerequisites in society for successful catching up should pertain. The history of Scandinavia, of North America, Australia and New Zealand, recently also of East Asia, documents that the active response to pressure on the market and towards peripherization is possible and that the attempts to catch up in spite of the differences in competence are not always doomed to

fail. To be a straggler can then also be seen as an opportunity. An attempt is then made to beat the more developed economy with its own weapons, by copying its technology and thus saving costs in development and by winning foreign markets with goods which are cheaper than they can be manufactured in the old industrial societies, because of higher costs for wages and infrastructure. Japan and, more recently, the East Asian fringe countries Taiwan and Korea have successfully exploited these opportunities.

Catching Up in Development

The international differences in competence between more and less advanced economies may lead to the less advanced being overwhelmed or may be used as a chance for an innovative response. The question then naturally arises of the basis of these different reactions. In this connection it is worthwhile to turn to an early authority on the theory and practice of development — Friedrich List (1789 to 1846). List was the first who clearly recognized the problem of catching up in development. Although he was a man of his time his arguments are still important. He was thinking of the England of the Industrial Revolution; the pressure on the market from English industry could be observed everywhere in Europe; the theoretical and practical debate could be summarized in the question of whether not only continental Europe but also the USA could effectively resist this English pressure, or if these economic areas would be simply overwhelmed by English goods and English know-how. F. List discussed this problem of catching up on development from the point of view of the states which were still in the transitional phase from the feudal and aristocratic

order to the industrial society. His arguments make it clear that, in the first half of the 19th century, the chances for development could be seen to be dependent on the extent and scope of the processes in society which were leading to defeudalization. F. List regarded appropriate societal and public conditions as being the foundation in his time for successful development, and this is still valid today as an essential prerequisite for development. His position has been supported by wide-ranging research in economic history since the middle of the last century, and was that a farsighted and efficient administration should replace feudal despotism, and that this administration should have the responsibility of promoting the economic structure of the developing country. A lethargic and privileged upper class had to be replaced by a business community, orientated towards profit and material prosperity. Serfs had to be replaced by independent farmers. F. List regarded well fed and well paid workers as being the prerequisite for increasing productivity at work. He contrasted the blessings of the work of the independent sciences and arts with the results of archaic fanaticism, as revealed in the wars of religion and in the inquisition. He regarded a spiritually and socially mobile society as being the opposite of traditional societies with their in-built barriers. Development had therefore something to do with the mobilization of energy which lay fallow in the traditional societies. Development would be blocked if this process was inhibited, only partially set into motion, or interrupted. This view sees freedom and permissiveness as the important preconditions for the process of development. A stable national basis is then just as important as safety before the law and the extension of self-administra-

tion — equally an independent enterprising spirit in all sections of the population a public administration which is capable of farsighted planning, a comprehensive traffic system, including streets, railroads and canals and an educational system with many components. If there was something that this early theoretician of problems of development gave precedence to, then it was esteem for imperial spiritual forces rather than for material values. F. List saw a source of energy and strength which would be difficult to substitute with natural resources in stimulation and encouragement of man's work and the inventive spirit, of knowledge and of ability, in other words, competence.

No Industrialization without Productive Agriculture

Another idea too of F. List is still worth mentioning. He had observed that processes of development need an efficient agricultural sector right from the start. This is because the role of agriculture is many-sided. Firstly, a growing urban population must be fed by a continuously decreasing number of agricultural raw materials. Also the agricultural sector cannot avoid supporting the industrialization in its initial phase and the comitant development of infrastructure by the either open or covert transfer of sources. On the other hand agriculture is an important market for every day industrial goods and for agricultural equipment. Therefore, in spite of considerable demands and encumbrances, a strong market must remain in rural areas, if total economic dynamism for development is to be maintained. This argument makes it clear how wrong it is to attempt a successfull industrialization without

ent...
popula...
is cap...
Preher...
s, rail...
al sys...
re was...
ian of...
ave p...
or imm...
n for m...
e of en...
difficul...
res in...
t of me...
of kn...
words...
still w...
ed an...
ct from...
of agr...
a gro...
l by a...
of agr...
agricul...
the in...
nd the...
rastruct...
agricultu...
y day in...
rural eq...
consid...
, a str...
areas, if...
or deve...
is argu...
s to atte...
without...
cient agriculture. Agriculture plays an important role in the strategy of development and this is often misunderstood. In the development programmes towards the end of the 19th and of the 20th centuries this obvious fact was more or less forgotten. The orientation was towards the success in development of the leading industrial societies and it was not recognized that the development of industry in these countries had had specific agricultural and institutional prerequisites. Only the many failures in development in recent decades have helped to revive this elementary insight. Countries which have had no institutional agricultural reform and which have not modernized their agricultural technology are incapable of realizing their potential for development. As a rule they get into serious bottle-necks and allow catastrophic structural defects to arise.

Mobilization of the Mental Capital

What other lessons can we learn from successful or unsuccessful development processes? The problem of mobilizing mental resources has already been addressed. Countries which lagged behind in teaching literacy to their populations and in the development of higher education, such as technical colleges, adult evening classes and technical and general universities, were not only less inventive societies than those with more differentiated educational opportunities, but also hindered social mobility. Their intellectual resources then lay fallow. Compare for example the situation in Scandinavia, where the teaching of literacy was furthered at an early date by church and state, with the situation in large areas of southern and south-eastern Europe, where neither church nor state showed

much interest in the spiritual emancipation of the population. In this connection it is also interesting to compare the East Asian societies of Japan, Korea, Taiwan, Hong-Kong and Singapore with their obsession with education, with other parts of the Third World in which much less effort of this sort can be observed. Moreover one can establish that the disproportionate mobilization of mental capital can make good a lack in natural resources. In this way, countries with few natural resources, which may also be small, can achieve a high degree of specialization in the niches of the world economy.

It is also of considerable importance for the developmental process that a branching infrastructure should develop. With increasing specialization in work and the resulting necessary interconnections between individual branches and sectors of the economy, an efficient infrastructure becomes an essential medium of communication between economic activities. As this infrastructure is in public possession it is not to be expected that individual businesses will provide this investment, which is necessary for the development of a national economy. Infrastructure is thus a public responsibility and those countries which have understood this fact have served their own development in this way.

Protective Measures

In recent history there has not been a single case of successful development arising from the free interplay of free forces. More or less state intervention has always been of considerable importance. So even when the forces in society are activated development does not run by itself.

This is particularly evident in respect

to the international economy, which is the framework in which the developmental processes must occur. This aspect, too, was shrewdly analysed by F. List. Today we think of him particularly as the protagonist of so-called protective custom duties for young (or "infant") industries. If it is a question of fending off the undesirable effects of leading on lagging economies, or of filtering or canalizing these effects, then appropriate protective measures in external trade are necessary, such as protective customs duties. These are intended to help the survival of young industries in the developing countries. However F. List's argument was more differentiated. He wanted those industries to be particularly protected which produce goods for mass consumption, as these are of central importance for the opening up of the internal market. He regarded it as not being sensible to protect the production of expensive and valuable goods for luxury consumption. The use of foreign machines and knowledge in the developmental process should be carefully directed, but always with the proviso that they should not simply overwhelm local technical skills. The ability to adapt foreign technology to local needs is particularly important here. Moreover it must be emphasized that protective measures have at no time been a cure-all. Depending on the degree of development they can be either beneficial or damaging, and they can also be premature or too late. In the critical early phase of catching up in development the problem is to find the correct balance between free international trade and protective measures and this balance should depend on the branch and sector. What is required is a qualified mixed strategy of partial decoupling from leading economies and partial adaptation to them. To find the appropriate mixture

and the right direction is the assignment of national politics at a high level. The trick is to demand neither too little nor too much of the developing economy. This is an experiment on the basis of trial and error and its success cannot be guaranteed from the start.

In this connection I must point to an unambiguous lesson from the recent history of development. Protective measures are only helpful along with simultaneous internal exertions towards development. If a country cuts itself off without trying hard to achieve internal development, finds that this protectionism leads to a dead-end. The recent history of development in the 19th and 20th centuries is full of examples. Thus it often happened that under the guise of protectionism archaic hindrances to development such as out-of-date agricultural structures and the continuing privileged position of groups in society, which had been strengthened rather than dismantled.

Problems of Crosslinkage

It is thus no easy assignment to set development off in the right direction. On the one hand damaging competition in the market from more highly developed societies must be fended off; on the other hand knowledge available elsewhere must be deliberately exploited to save costs. Within a country successful development is dependent on broad and effective linking between agriculture, industry and trade. In the real world it occurs far more often that industrialization leads to devolution of agriculture, to the unbalanced advantage of conurbations. The deepening political, social, economic and cultural chasm is then the breeding site for many a developing social catastrophe.

for the break-down of agricultural self-sufficiency, for flight from the land and mass rural pauperism, for excessive urbanization, for unemployment and underemployment and finally for uncontrolled population growth, that with its own momentum deletes or reduces partial successes in development. Just those many negative experiences teach us that only broad mobilization of idle resources in all areas of society, but particularly in agriculture, can lead to success. As a rule, preceding or concomitant reform measures are requisite, without which the attempts at industrialization remain outside the rest of society and usually fail. The skill of correctly judging external economic conditions for the planned development must be allied to the practical trick of dismantling disadvantageous agricultural structures and of creating new opportunities for the growth of forces leading to development.

Such arguments may seem to be abstract or even technocratic, but they are of course intended to be quite objective and describe very real political facts. Protective measure in foreign trade either favour or are to the disadvantage of concrete interest groups. Literacy provides the foundation for the spiritual emancipation of man and undermines archaic power structures. Changes in the infrastructure here favour the regions in which they occur. A continuous conflict of interest between rural areas and conurbations is programmed in all developmental processes. In other words, the processes of development cannot run smoothly and are much more the result of political conflict. The specific balance of power decides in which direction the developmental processes are canalized. For example, if the power of rural oligarchies and of trading capital is unbroken, then the development

of an enclave economy is more or less inevitable. On the other hand, the development of a national capitalism is probable if, in the conflict between established interests and the arising bourgeoisie, victory is won by innovative groups, together with urban workers who are organizing themselves in trade-unions, coupled to a developing middle class in the service sector. Other basic constellations could also be described. These interrelationships also make it clear that development, failed development and certainly underdevelopment are not simply connected to the presence or absence of natural resources. It is also clear why technocratic development programmes which are meant to produce development in spite of bypassing the political power structure are usually doomed to failure. Political economics is necessary to understand modern problems in development.

Lessons from the Collapse of "Real Socialism"

The political content of developmental processes was always discernible in the classics in this field. Only after 1945 was the discussion increasingly restricted to economic issues. This was particularly expressed in recent years in the socialist countries, which are normally excluded from the discussion of development. If freedom in society is repressed, as in the Stalinistic model of development, then one of the most important resources for development, namely the free unfolding of individuals and groups, is destroyed. Negative consequences for the total economy cannot be avoided if agriculture is constantly sucked dry. Overemphasis on building up heavy industry leads to the production of goods which are irrelevant to the obvious daily needs of the consum-

ers. Motivation disappears and general apathy results. Both the division of labour and interconnections between productive forces are hindered if the service sector is neglected and misunderstood for ideological reasons as "unproductive". Total isolation from other countries, i.e. autarchy, removes the stimulus to innovation, which had two negative consequences in the socialist system. In countries with state monopolies not only all possible external competition, but also internal competition, a possible source of innovation, were swept aside. Moreover the socialist system demonstrated that growth is a necessary but not an adequate condition for development. The balance of the development and its distribution are much more important.

What was missing in the socialist system can be understood immediately from a historical view of development: the emancipation of the society from the monopoly of state and party and in particular the transition from a sort of despotism to benign absolutism and finally to democracy; the creation of political freedoms as a starting point for self-activating forces in society; political participation and self-administration; agricultural reform which has recognized the universal experience that independent or co-operatively organized units of intermediate size bring high productivity; an increase in productivity in all sectors of the economy by shifting the priorities for growth from raw material and heavy industry towards

consumer goods industry, by furthering the construction of technologically advanced machines; development of infrastructure; appreciation and support of the service sector; finally, increasing opening other countries by intensification of exchange of people, goods, technology and capital. The rebuilding of these societies was long overdue. As is well known it came too late. The internal contradictions could not be resolved under the ancien régime. Given the considerable changes in the rest of the world the contradictions had to intensify, leading inevitably to a more or less revolutionary situation. As with every real revolution the timing and extent of the East European could not have been predicted.

Central direction of the whole process of development must lead to failure. Leaving the processes of development to the free play of economic and social forces can only exceptionally succeed as has historically hardly ever happened. It is therefore a question of freeing social forces and of letting them develop under conditions which demand neither too much nor too little of them. This has always been an extremely difficult task. The view of the fact that the cleft between leading and lagging economies has widened rather than narrowed in recent decades this task has not become any easier. Perhaps this is one of the reasons why the problems of development are now one of the central issues in international politics.

English Translation by R. A. K. Senghaas

Evolution – Brain – Consciousness

The Evolution of Human Consciousness

Franz M. Wuketits, Vienna/Austria

The problem of consciousness is one of the both most fascinating and most difficult both of philosophy and of individual sciences. Can consciousness be regarded separately from matter? Or is it identical to matter? Has only the human being consciousness or can consciousness be ascribed to other living creatures (or even to machines)? In recent times these and similar questions have been discussed particularly from the scientific point of view. The contribution of biology has been particularly important in achieving an increase in the precision with which these questions can be put and in the exactness with which they can be treated.

Descartes was of the opinion that it is our own nature which teaches us that we have a body, that this body at this or that instant feels well or unwell, that it needs food or drink, that it feels pain, etc. It is also this nature which teaches me that "there is a multitude of other bodies in the neighbourhood of my body and of these I should go to some and avoid others".¹ I therefore perceive both myself and my environment, which I can critically regard from a distance. This ability of critical dissociation from objects and events in the external world and particularly the ability of "self-perception" are widely described as *consciousness*. According to Sartre: "The consciousness of

something necessarily implies, if one is to remain conscious, the consciousness of oneself."² Thus consciousness would be equivalent to "self-consciousness".

Particularly the following criteria pertain to this self-consciousness:³

1. The knowledge of one's own life, i. e. the ability to go at a distance to one's

Dr. Franz M. Wuketits was born in 1955 and studied biology and philosophy in Vienna. 1978 Doctorate; 1980 University Lecturer for the Theory of Science (particularly Biological Science) at the University of Vienna, additionally at the University of Graz (since 1987). 1990 to 1991 Director of the Konrad Lorenz Institute for Research in Evolution and Cognition in Altenberg on Danube. Main areas of work: Theory and history of biology, natural philosophy, evolutionary epistemology, biology and ethics, anthropology. Among his numerous publications the following are particularly important: Key to Biology (1986), Key to Philosophy (1987), Genes, Culture and Morals (1990), Evolutionary Epistemology and Its Implications for Humankind (1990).



Univ. Doz. Dr. Franz M. Wuketits, Institut für
Wissenschaftstheorie der Universität Wien,
Sensengasse 8, A-1090 Wien/Austria

own life and to reflect critically about oneself.

2. The ability to have intentions, to set goals, to plan one's own future.

3. The ability to reflect on the conditions of one's own existence, i. e. to win insight into one's own existence, its present, past and possible future.

These criteria pertain only to *human* consciousness. The emphasis on "human" in this context is also intended to indicate that we cannot principally concede consciousness only to human beings. For various other living creatures, particularly mammals (and even more so primates) are capable of astonishing achievements in memory and association, can learn and can even make attempts at "planned behaviour".⁴ It is thus easy to assume that various animals have abilities which are at least analogous to human consciousness.

However self-consciousness in the more narrow sense can probably be ascribed only to humans, particularly when it is defined as follows: A living creature is only conscious of itself when it knows who or what it is.⁵ Admittedly with the chimpanzee we can assume a budding *self-awareness*⁶. On the other hand neither the chimpanzee nor any other animal seems to possess the following abilities:

1. An overview of protracted time spans, both in the past and in orientation towards the future.

2. The connected ability to direct one's own actions not only towards the immediate but also to the more distant future, even when this lies years away.

3. The knowledge of one's own transitoriness, in other words knowledge of death, coupled to the effort to make the prospect of one's own death tolerable or to suppress awareness of it.

These are specific characteristics of human consciousness, which is thus qua-

litatively different from "animal selfception". We will consider later the question of how this new quality could have arisen in evolution. First it is advisable to take a short look at some suggestions aimed at solving the consciousness problem. These ideas have played an important role not only in the history of philosophy, but also in several individual sciences, and are still widely discussed. They are essentially attempts to solve the old *mind-body problem*, in other words to understand the relationship between matter and spirit. This is certainly one of the most difficult problems in philosophy.

Consciousness and Matter

Without attempting completeness I shall now describe some of the schools for the thought which have attempted to solve the problem of the relationship between consciousness and matter. The problem of consciousness and matter can also be defined as the *brain-consciousness problem*, as in recent times it has been assumed that consciousness (or spirit) must have something to do with the brain.⁷

Firstly, two extreme positions are possible. There is the conviction that consciousness and brain are identical, that consciousness can be reduced to matter and is practically non-existent (*strict materialism*). Then there is the view that consciousness leads an independent existence, free from matter (i. e. the brain) and practically exists parallel to the matter (*parallelism*). Both positions have been presented in various forms up to the present day. The basic controversy is one between *monism* and *dualism*. It will be noted in advance that the biological school of thought, based on the theory of evolution, excludes dualism and leads to a variant of monism. An inverted monism

has also been proposed, namely the view that matter can be reduced to spirit and that in reality only consciousness exists. This spiritualistic approach was taken for example by George Berkeley (1685 to 1753) and Georg Wilhelm Friedrich Hegel (1770 to 1831), while Aristotle considered that matter and spirit form a unity which is only conceptually separable. On the other hand the biologist and natural philosopher Bernhard Rensch (1900 to 1990) proposed panpsychistic identism or panprotopsychism, according to which "proto-psychic properties" are principally ascribed to matter.⁸

There are several variants to dualism. Here I will only mention interactionism, which was already proposed by René Descartes (1596 to 1650) as a hypothesis for the interaction between body and soul and which has been particularly advocated in recent years by the neurophysiologist John Eccles.⁹ Eccles regards certain "liaison centres" in the brain as where the interaction between brain and consciousness occurs. However it cannot be made out which parts of the brain these actually are. (Descartes took the site of interaction to be the pineal gland, a gland-like structure in the middle brain of vertebrates.)

Criticism of Dualism

The simple fact that interactionism posits indefinable parts of the brain as sites of the postulated interaction permits the recognition of a weak point in this form of dualism. Gerhard Vollmer, for example, sees a weighty argument against the interaction hypothesis in the fact that the view that the spirit (consciousness) is an immaterial substance must allow a contravention of the law of conservation of energy:¹⁰

"At least for the material partner each interaction ... must be coupled to a transfer of energy. From the physical point of view small quantities of energy must then continually appear and disappear in the brain. In fact Eccles conceded this possibility to save his interactionism".

We can also start from the following general argument: As an example let us look at the phenomenon of movement, a basic property of most (at least most animal) living creatures. Someone could come on the idea that a living creature and its movement are two different categories, i. e. that movement is a phenomenon separate from the individual creature. Further, one could presume that there is an interaction between a living creature and its movement. The absurdity of such an interactionism would be recognizable by the question of where this interaction should take place — in the knee joint or in the wings, if we are thinking of a bird. In fact, for reasons connected with the logic of cognition and with the theory of science, science cannot satisfy itself with postulating material and immaterial categories in this world, without making clear how these categories are connected. Explanations of the existence of the immaterial are principally outside the scope of the procedure of the natural sciences to arrive at a causal explanation of natural phenomena.

Even Santiago Ramón y Cajal (1852 to 1934), one of the pioneers of modern brain research, emphasized that a hypothesis should "not mention the occult properties and metaphysical relationship of a problem to put the qualitative questions in a quantitative form."¹² Not, that a quantification of the very complex brain or consciousness phenomena should supplant the qualitative aspect of these phenomena, but that a hypothesis cannot

be fruitful when it includes elements of the inexplicable *ab initio*. Thus, however attractive the independence of consciousness as a category removed from matter may appear to some people, every dualistic view of brain and consciousness is "unscientific". It is more the case that the assumption of the existence of the immaterial corresponds to religious convictions, which may have their justification, but which may not be blended with the explanations of natural science.

Consciousness as a Property of the Brain

It is of course undeniable that consciousness "exists". However if this is not a reality which is remote from matter (i.e. the brain) the question arises again of what this consciousness actually is and of how it is connected to the brain. An initial and suitable working hypothesis could be that there is a coincidence between the processes in the brain and the processes in consciousness. This correspondence or parallelism is the starting point of the very detailed philosophical and neurobiological studies of Hartwig Kuhlenbeck (1897 to 1985).¹³ Consciousness here is not uncoupled from the brain, but every conscious process which we feel or observe must correspond to a physical event. Basically the old mind-body problem only arose because matter and spirit were separated from another *ab initio*, and the problem then arose of their interrelationship.

Now the approach based on a correspondence between physical events and conscious processes could lead us into the same trap. For how does this correspondence arise? Perhaps we will have to assume an (unknown) agency which guarantees this correspondence between brain

and consciousness. Thus we may go back to the idea of a pre-established harmony, based on the assumption that there is an established parallelism between matter and spirit once and for all during creation. This idea originated with Gottfried Wilhelm Leibniz (1646 to 1716). It had much influence in the history of philosophy but will not bring us any further here.

The only workable idea seems to be to regard consciousness as a *property of the brain*.¹⁴ Let us take again the movement of a living creature as an example. Movement is always a specific property of a living creature, which arises from a complex interaction between different organs and cannot be separated from the living creature. I cannot say: "Here is the living creature and there is its movement". It is much more correct to say that a living creature is able to move, if certain physical, chemical and biological, initial and peripheral conditions are fulfilled. The central lemma of this dualistic approach consists of the separation between properties of events and objects¹⁵, which necessarily leads to a philosophical dead-end. In connection Ryle speaks of the (dualistic) error in categories and illustrates it with the following example:¹⁶

A visitor comes to Oxford or Cambridge and is shown the libraries, museums, institutes and administrative buildings of the university. He then asks: "But where is the actual university? I've seen the different buildings, but still don't know where the university is."

This man has made the error of thinking that "the university" is another, additional institution, separate from the individual scientific institutes, libraries, etc. One must therefore explain to him that "the university" is nothing else than the way that all the premises that he has seen are organized.

This example makes it clear that "the university" has no life which is independent of material objects, premises or places of work, but which depends on the specific collaboration between these. Similarly one can say that consciousness is not an independent category, but results from the specific contacts between material elements. Moreover we should not make the mistake of seeing brain and consciousness statically; it is much more a question of processes. Restak¹⁷ remarks to this:

"Categorical errors arise when we regard the brain and spirit as objects, while it is really a question of processes. Such a confusion leads to fallacies in relation to our behaviour. Of course if we make the wrong assumptions we land with unusable theories, which bring us no further."

In the hope that we are starting with a initial correct assumption we will now regard consciousness as a *systemic property* of the brain. The brain, by which we mean the *human brain*, as we are dealing with human consciousness here, is the most complicated of any individual system known in the organic world.

this world has a history, which is sometimes incredibly long.

It is a commonplace in biology that species are changeable, that all structures and functions of life have arisen gradually and have their origins in the remote past. In biology there is not a single really serviceable alternative to the explanatory approach based on the theory of evolution. We assume that complex psychic and spiritual phenomena are of evolutionary origin too.

Even Charles Darwin (1809 to 1882) made a comparative study of the expression of emotions in different living creatures, including humans. He inferred that phenomena such as fear, hate, anger, joy etc. can be explained on the basis of biology and evolution, and that they have biological significance.¹⁸ Various evolutionary theories of the behaviour of living creatures and of (human) consciousness have been developed as extensions of Darwin's studies.¹⁹ In these theories at least two things are clear:

1. Consciousness is always based on a material substrate (brain) and cannot exist separately from this.
2. Reconstruction of the developmental history of the brain therefore also permits conclusions about the evolution of consciousness.

Somewhat more modestly, one could perhaps say that at least the biological preconditions for the development of human consciousness can be illuminated on the basis of organic evolution. On the other hand, the history of all that this consciousness is capable of and has produced (*culture*) is also dependent on other factors, and its development in relation to organic evolution has an independent dynamism.

The evolution of the human brain should be seen in the setting of the evolu-

The Evolutionary Approach

Ignoring its complexity the brain can be seen as a biological organ like any other. As all organs have arisen during the course of *evolution* and can be explained on the basis of their history, the brain too is explicable as a product of (organic) evolution. If then consciousness is seen as a property of the brain, then the evolutionary approach should be applicable to its explanation too. The evolutionary theory sees nothing in this world as static. Everything changes, everything that we observe in

tion of the vertebrate brain, or in the wider setting of the evolution of neural capability in animals.

Evolution of the Brain and the Appearance of Consciousness

We should see the first psychic movement in the most general sense "where we first meet with an anatomical nervous system when scaling the animal kingdom".²⁰ As we are interested here in the conditions for the occurrence of *human* consciousness, we can restrict ourselves to the evolution of the human brain. The following important evolutionary steps can then be reconstructed:²¹

- The evolution of the vertebrate central nervous system proceeds with enlargement and differentiation of the brain. These developmental processes are particularly marked in the *cerebrum*. More and more the brain becomes the integrative component of the central nervous system, to the steering and control system of life.
- About 250 million years ago the rep-

tilian forebears of the mammals had live nocturnally, so that the auditory and olfactory organs had to be developed. This was an important step in the *encephalization* of the functions. Information processing was shifted from the periphery into the central nervous system, a resulting increase in brain size.

■ About 70 million years ago mammals, some of which had become diurnal, improved their visual organs. To improve the effectiveness of information processing it was necessary to co-ordinate the visual system with the auditory and olfactory organs.

■ Finally, the development of a markedly "optical behaviour" characterizes the evolution of the primates. This is connected with the ability of spatial vision, colour perception and of exact coordination between the eye and the frontal tremities.

The evolution of the human brain can only be understood on this basis. The evolution of the hominids (human species) took place over about 5 million years.²² What is particularly striking

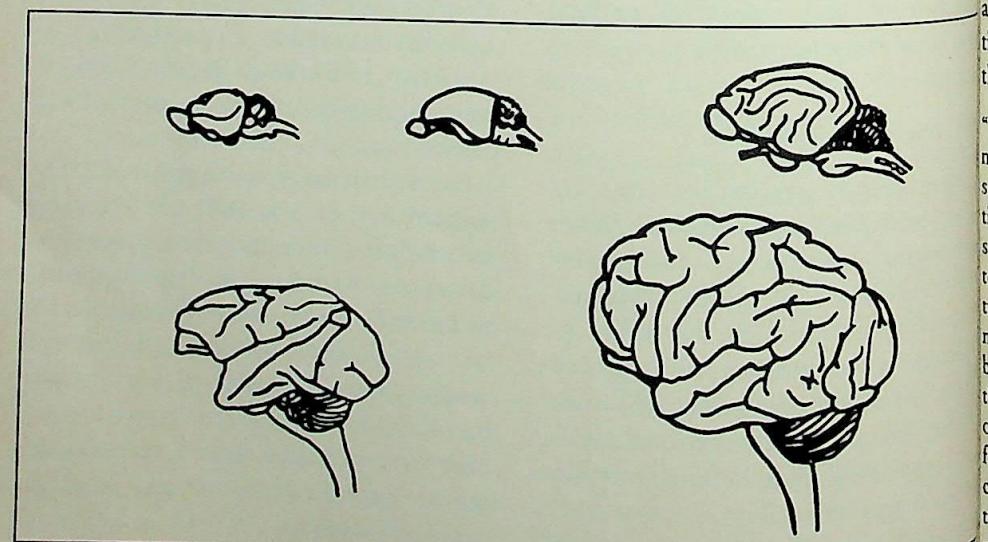


Fig. 1: Brains of some modern mammals. Above (from left to right): opossum, hare, cat. Below left: *macaque*. Below right: chimpanzee.

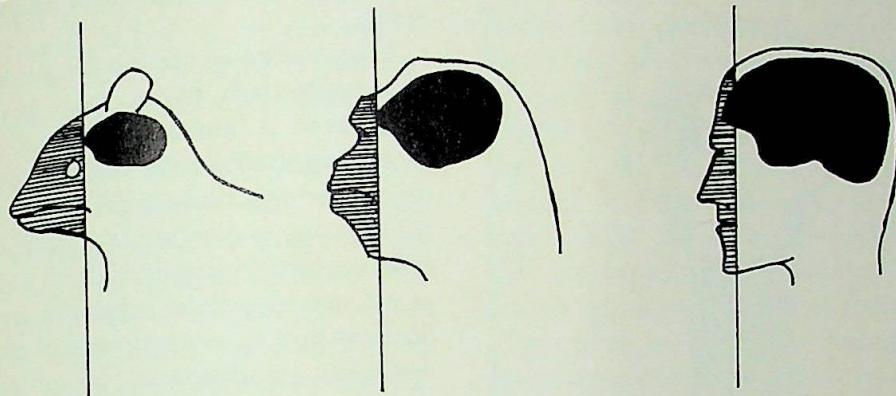


Fig. 2: Enlargement of the neurocranium at the cost of the facial part of the skull is a characteristic of human evolution. For comparison, the proportions are shown schematically in a primate and in a "more primitive" mammal.

is the progressive *cerebralization* or increase in size of the brain from originally about 500 cm^3 to an average of 1500 cm^3 in modern man, *Homo sapiens sapiens*. The evolution of the hominids should thus be seen substantially from the point of view of the evolution of the brain. It would however be a mistake to see this evolution only as a question of an increase in mass, i.e. an increase in the number of brain cells. It was much more a question of differentiation, of "qualitative growth". We can therefore establish that:²³

"The evolutionary differentiation of the central nervous system has lead to the development of several subsystems for defined partial functions. These in turn possess most complicated substructures, which have defined and characteristic capabilities. On the other hand a multitude of multifarious internal connections are necessary to bring together the individual branches of the subsystem and to bring this then under central control. The external form of the brain shows a layering of individually formed buildings blocks, from the spinal chord up to the cerebrum. The internal structure of this corresponds to the hierarchical order of overlapping levels of integration, of increasing complexity."

Admittedly these are for the present very general statements. However they make it clear to us how we should see the brain: as a complicated, hierarchically ordered system with interactions between elements and subsystems at various levels. It was just these mutual connections between elements and subsystems which presumably lead to the more and more complex achievements of the brain and finally to the appearance of (human) consciousness.

Fulguration?

Konrad Lorenz (1903 to 1989) has emphasized that the appearance of human consciousness was an epoch making event in the history of life and that the "spiritual life" of man must be regarded as a "new sort of life".²⁴ He spoke of a fulguration (from the Latin *fulgur* for lightning) to indicate that human consciousness is a phenomenon that must have appeared suddenly and abruptly and which was not present before, even in traces.

As emphasized above, human consciousness possesses properties which our knowledge of animal behaviour sug-

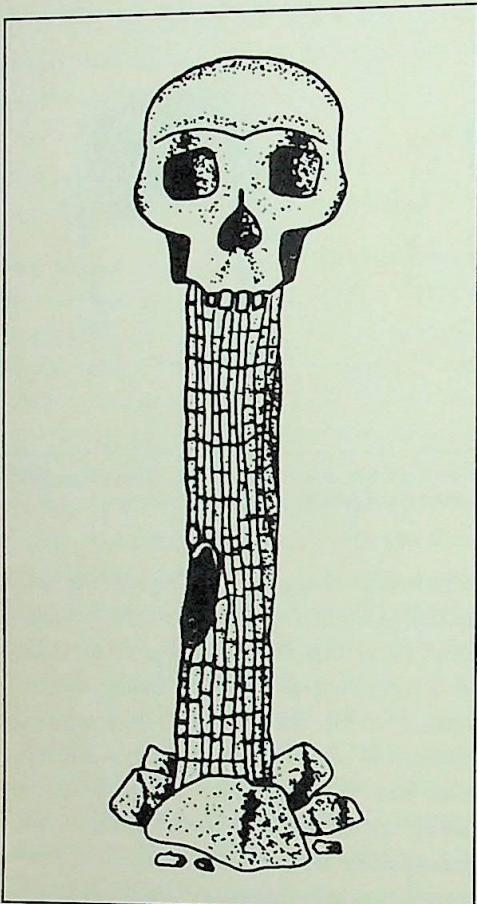


Fig. 3: Skull cult of neandertal man.

gests cannot be ascribed to other living creatures. In this connection I would like to refer again to the knowledge of death. It has been known for a long time that neandertal man (an extinct evolutionary branch of *Homo sapiens*) buried his dead and decorated the graves with flowers.²⁵ This allows the conclusion of a belief in a life after death and assumes a consciousness which must have been very similar to our own. There is not the slightest indication that animals have this consciousness of death, coupled with the hope of an afterlife. Was then the appearance of human (self-)consciousness an abrupt event which occurred in shadowy primeval time, at the time of the neandertals

about 70 000 years ago, or perhaps earlier?

All evolution of life is a process which continually leads to the arising of something new: A multicellular organism, something qualitatively different from unicellular organism; animals with a central nervous system are at a qualitatively different level from animals with a simple neural net; unicellular organisms are qualitatively new in comparison with the molecular structures in the primordial soup of 4 billion years ago. Evolution of life can be seen as a process of integration: The integration of molecular structures made more complex systems (cellular creatures) possible; the integration of cells lead to multicellular animals; the integration of nerve cells lead to complex brain, which was finally ever in the position to reflect about itself.

It cannot be accepted that in evolution new systemic qualities or properties appear literally overnight or like lightning. However it appears really plausible that the specific "switching together" of elements — such as the specific integration of neurones or brain cells — lead relatively quickly to qualitatively new systemic properties. From this point of view, Konrad Lorenz's concept of fulguration is extremely useful, particularly when it is used to make clear that the whole (the brain) is more than the sum of its parts, that it has developed systemic properties which exceed those of its parts. It would in fact be senseless to search for consciousness anywhere in the brain or even in a single brain cell. It is not there; it is a total systemic property of the brain, dependent on its very specific arrangement.

Sceptics may object that the considerations presented here do not lead to a solution of the old mind-body problem. Certainly, the problem is not solved

considerations of evolutionary theory if it is formulated as one of the relationship between something material (brain) and something immaterial (consciousness).

The Significance of the Biological, Evolutionary Approach

However the decision for dualism excludes a scientific solution ab initio. The evolutionary view of the problem is then nothing more than a reformulation. It must be emphasized once more that the question is not of how brain and consciousness interact. It is rather a question of seeing consciousness as a systemic property of the brain and of investigating under which conditions the brain develops the property of consciousness.²⁶ The problem is then seen as part of biology and we can expect important contributions to its solution particularly from neurobiology. Of course this point of view has profound anthropological consequences.

We understand that our consciousness cannot be separated from its material substrate. Oeser and Seitelberger formulated this as follows:²⁷

"While in former times one could still believe that the human spirit has its own substance, that it reappears indestructible and unchanged after every physical disease and that it even survives the death of the body, brain research has taught us something else. The brain does not belong to the 'I', as the dualists maintain, but the exact converse: The 'I' belongs to its brain as a simple functional reality."

It may be a question of the individual temperament or personality if it is a comfort for someone to recognize that his consciousness is an inherent part of the long chain of organic development on this planet and is a part of nature. In any case evolutionary science does not see itself as a road to salvation.

The biological and evolutionary approach is also important in relation to the theory and methodology of science. The approach provides a comprehensive matrix for psychology. By definition psychology deals (but not exclusively) with phenomena of consciousness. It then develops in many areas into a biological science²⁸ and evolutionary psychology²⁹ will become more and more important.

It appears to me that the biological approach to the discussion of the consciousness problem should also take precedence over the expectations based on research into artificial intelligence³⁰. I adhere to the view that we can learn more about our own consciousness if we investigate the properties of the consciousness of animals — as we are phylogenetically related to animals, but not to computers.³¹ I would therefore make a plea for paying less attention to artificial intelligence (created by us!) and more attention to our own intelligence and that of our closest relatives.

In general the evolutionary approach to the discussion of the consciousness problem can achieve two things. Firstly, we can win insight into the evolutionary conditions which must have been fulfilled to allow the appearance of consciousness at all. Secondly, the more we know about these conditions, the more we can understand the preconditions which have led to the appearance of culture and have made *cultural evolution* possible. This has not been dealt with in this article. I would only like to indicate that it cannot be doubted that cultural evolution also sets conditions for the development of human consciousness, that these go beyond biological conditions and cannot be reduced to these. On the other hand the appearance of culture was only possible on a biological basis. Thus the human brain

with its capability of consciousness forms an intersection between nature and culture — reason enough to occupy oneself with the achievements of this wonderful system.

English translation by R. A. Yeates

¹ Descartes, R.: *Meditations on the Bases of Philosophy.* (Meditationen über die Grundlagen der Philosophie.) Leipzig 1902, p. 70. — ² Sartre, J. P.: *Consciousness and Self-Knowledge.* (Bewußtsein und Selbsterkenntnis.) Reinbek 1973, p. 31. — ³ Cf. Meinecke, G.: *The Problem of Consciousness. On its Rediscovery in the Programmed World.* (Das Problem des Bewußtseins. Über seine Wiederentdeckung in der programmierten Welt.) Berlin 1969. — ⁴ Rensch, B.: *Memory, Concept Formation and Planned Activity in Animals.* (Gedächtnis, Begriffsbildung und Planhandlungen bei Tieren.) Berlin/Hamburg 1973. — ⁵ Bunge, M./Ardila, R.: *Philosophy of Psychology.* New York/Berlin/Heidelberg 1987, p. 237. — ⁶ For example this is also the case with the orang-utan. See Lethmate, J./Dücker, G.: *Studies on Self-Recognition in the Mirror with Orang-Utans and in some other Monkey Species.* (Untersuchungen zum Selbsterkennen im Spiegel bei Orang-Utans und einigen anderen Affenarten.) Z. Tierpsychol. 33 (1973), p. 248 to 269. — ⁷ For the following see the detailed descriptions in: Bunge, M.: *The Mind-Body Problem. A. Psychobiological Approach.* Oxford/New York/Toronto 1980, p. ff.; Wuketits, F. M.: *State and Consciousness. Life as a Biophilosophical Synthesis.* (Zustand und Bewußtsein. Leben als biophilosophische Synthese.) Hamburg 1985, p. 201 ff.; Ib.: *Key to Philosophy.* (Schlüssel zur Philosophie). Düsseldorf/New York/Vienna 1986. (Taschenbuchausgabe [Pocket Book Edition] Munich 1991), p. 116 ff. — ⁸ Rensch, B.: *Biophilosophy Based on the Theory of Cognition. (Panpsychistic Identism.)* (Biophilosophie auf erkenntnistheoretischer Grundlage. [Panpsychistischer Identismus].) Stuttgart 1968; ib.: *The Universal World View. Evolution and Natural Philosophy.* (Das universale Weltbild. Evolution und Naturphilosophie.) Darmstadt 1990. (New Edition, ed. by F. M. Wuketits); see also Wuketits, F. M.: *The Panpsychistic Identism of Rensch as a Possible Approach in Modern Natural Philosophy.* (Der panpsychistische Identismus im Sinne von Rensch als Denkmöglichkeit moderner Naturphilosophie.) Philos. Nat. 17 (1978), p. 10 to 30. — ⁹ Eccles, J. C.: *Facing Reality. Philosophical Adventures by a Brain Scientist.* New York/Heidelberg/ Berlin 1970; ib.: *The Human Mystery.* New

York/Berlin/Heidelberg 1979; see also Huene/F.
 K. R./Eccles, J. C.: The Self and Its Brain. A defense of Interactionism. New York/Heidelberg and Berlin 1977. — ¹⁰ Vollmer, G.: Evolutionary Epistemology and the Mind-Body Problem. (Evolutionärer Erkenntnistheorie und Leib-Seele-Problem.) In: *Alber Texte* 23 (1980), pp. 11 to 40, here p. 10. —
¹¹ Bunge, M. (Ref. 7), p. 16 ff. — ¹² Ramón y Cajal, F. M. W.
 Rules and Advice for Scientific Research. (Ratschläge und Ratschläge zur wissenschaftlichen Forschung.) Munich 1938, p. 105 f. — ¹³ Kublenbeck, H.
 Human Brain and Its Universe. 3 Vols. Munich/Paris 1982. — ¹⁴ See also Wuketits, F. M.
 Problem of Consciousness from a Biological View. (Das Problem des Bewußtseins aus biologischer Sicht.) Österr. Ärztezeitung 35, 1 (1982), 24 to 26; ib.: Cybernetics, Brain and Consciousness. (Kybernetik, Gehirn und Bewußtsein.) Umschau (1981), pp. 77 to 79; ib.: Biophilosophy Today. Elements, Problems, Perspectives. VI: Brain, Mind and Consciousness. (Biophilosophie heute. Mente, Probleme, Perspektiven. VI: Gehirn, Geist und Bewußtsein.) MNU 36 (1983), p. 70 to 75. — ¹⁵ See also Bunge, M. (Ref. 7). — ¹⁶ Ryle, G.: Concept of Mind. Harmondsworth 1966, p. 17. — ¹⁷ Restak, R. M.: Psychobiology: The Last Frontier. (Geist, Gehirn und Psyche. Psychobiologie. Die letzte Herausforderung.) Frankfurt/M. 1981, p. 18. — ¹⁸ Cf. Darwin, C.: The Expression of the Emotions in Man and Animals. London 1872. (German translation as copy of the German first edition, Niemeyer 1986). — ¹⁹ See the comprehensive study of Richards, R.: Darwin and the Emergence of Evolutionary Theories of Mind and Behavior. Chicago/London 1987. — ²⁰ Ziehen, T.: Guide to Physiological Psychology. (Leitfaden der Physiologischen Psychologie.) Jena 1914, p. 5. — ²¹ Cf. Oeser, E./Seitellier, F.: Brain, Consciousness and Cognition. (Gehirn, Bewußtsein und Erkenntnis.) Darmstadt 1988, p. 52 ff. — ²² For a review see e.g. Vogel, W.: Evolution of Mankind. (Evolution des Menschen.) In: R. Siewing (ed.): Evolution. Conditions, Results, Consequences. (Evolution. Bedingungen – Resultate – Konsequenzen.) 3d Edition, Stuttgart/New York 1987, pp. 415 to 452. — ²³ Oeser, E./Seitellier, F. (Ref. 21). — ²⁴ Lorenz, K.: Behind the Mirror. Search for a Natural History of Human Knowledge. (Die Rückseite des Spiegels. Versuch einer Naturgeschichte menschlichen Erkennens.) Zurich 1973. — ²⁵ See for example Wissner, W./Schweikhardt, J.: Expedition Man. Excursion into Anthropology. (Expedition Mensch. Streifzug durch die Anthropologie.) Vienna 1982, p. 1. — ²⁶ Also see Löwenhard, P.: The Mind-Body Problem. Some Neurobiological Problems. In: P. Höglund, P. Höglund (eds.): *Philosophical Problems in Biology*. Stockholm 1982, p. 1.

also Huene/F. M. Wuketits (eds.): Reductionism and System Theory in the Life Sciences. Some Problems and Perspectives. Dordrecht/Boston/London 1989, pp. 85 to 135. —²⁷ Oeser, E./Seitelberger, F. (Ref. 21), p. 190. —²⁸ Cf. Bunge, M./Ardila, R. (Ref. 5). —²⁹ See here p. 100. —³⁰ H. Medicus, G.: Evolutionary Psychology. (Evolutionärer Psychologie.) In: J. A. Ott/G. P. Wagner/C. F. M. Wuketits (eds.): Evolution, Order and Cognition. (Evolution, Ordnung und Erkenntnis) Berlin/Hamburg 1985, pp. 126 to 150; also ib.: Towards and Etho-Psychology: A Phylogenetic Tree of Behavioural Capabilities. Ethology and Sociology. 8 (1987), pp. 131 to 150. —³¹ For a review of this problem area see e.g. Irrgang, B./Klawitter, J. (eds.): Artificial Intelligence. (Künstliche Intelligenz.) Stuttgart 1990.

tion. (Evolution, Ordnung und Erkenntnis) Berlin/Hamburg 1985, pp. 126 to 150; also ib.: Towards and Etho-Psychology: A Phylogenetic Tree of Behavioural Capabilities. Ethology and Sociology. 8 (1987), pp. 131 to 150. —³⁰ For a review of this problem area see e.g. Irrgang, B./Klawitter, J. (eds.): Artificial Intelligence. (Künstliche Intelligenz.) Stuttgart 1990. —³¹ Bunge, M./Ardila, R. (Ref. 5), pp. 110, 160.

Evolution and Projection

Approaches to a Modern Epistemology

Gerhard Vollmer, Braunschweig

Evolutionary Epistemology is a young discipline combining elements from philosophy and individual sciences. It is based on the thesis that cognition is a function of the brain and as such is also a result of biological evolution. It examines the arguments for or against this view and tests their epistemological consequences. For this it requires the findings of perceptual, developmental and learning psychology, of linguistics, of neurophysiology, of comparative ethology, of genetics, but most of all of evolutionary theory in its currently accepted form.

Fundamental thoughts of Evolutionary Epistemology can already be found in Darwin and in many later authors. Whereas most of them were content to mention them in passing, however, as neither philosophers nor biologists were willing to venture too far into unfamiliar terrain, it was Konrad Lorenz in the 1940s who achieved the decisive linking of evolutionary theory and epistemology. However, his papers remained unread or misunderstood until the theses of Evolutionary Epistemology were further developed and made more widely accessible by the work of Lorenz, Campbell, Vollmer and Riedl in the 1970s.

What Is Cognition?

It is not easy to define the concept of "cognition" in a non-circular way. Here we will

be content with a working definition: partial characterization: the cognition reality is an adequate (internal) reconstruction and identification of external objec

In our explication we restrict ourselves to the cognition of reality. Although logical and mathematical cognition also

Professor Gerhard Vollmer, born in 1943 in Speyer on Rhine. Studied mathematics, physics and chemistry in Munich, Berlin and Freiburg/Breisgau. Doctorate in Freiburg in 1971. Till 1975 ass. prof. of theoretical physics in Freiburg,

while at the same time continuing studies in philosophy and linguistics. Ph. D. in philosophy in Freiburg in 1974. From 1975 to 1981 at the Department of Philosophy, University Hannover. From 1981 to 1991 professor at the Centre for Philosophy and Foundations of Science, University of Giessen. Since 1991 professor of philosophy, Technical University of Braunschweig. Fields of research: logic, epistemology, philosophy of science, foundations of physics and biology, natural philosophy, artificial intelligence. Some of his numerous publications are listed at the end of the article.

Prof. Dr. Dr. Gerhard Vollmer, Seminar für Philosophie, TU Braunschweig, Geystrasse 7, W-3300 Braunschweig/Germany



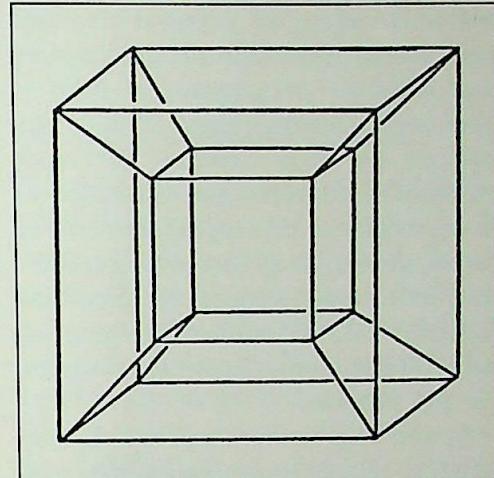
the structural sciences are adequately served by a less stringent concept of cognition. Apart from such formal conditions as internal consistency, the cognition of reality must fulfill further criteria; in particular, it must refer to objects in the real world. Moreover, it must be correct and true. A normative condition such as this is also already inherent to the concept of reconstruction. A mere construction would be totally arbitrary; a reconstruction must have the same structure as the actual object.

An essential characteristic of the (hoped-for) cognition of reality is thus the (hoped-for) isomorphism. Ethical, aesthetic, religious or mystic "cognition" do not fulfill these conditions, or at least not in a verifiable way, and will therefore not be further discussed.

An Example

Upon careful scrutiny, the two-dimensional line drawing in Fig. 1 can be *interpreted* as a three-dimensional object: a small cube is suspended within a larger one; the oblique lines connect the corresponding corners in pairs. Have we then recognized the object? The answer would be "yes" if it were in fact (nothing but) a wire construction. But we can take our reconstruction further and interpret the drawing as representing (in central projection) a four-dimensional cube.

The difference between cube and tesseract is, however, not just quantitative, i. e., one of the number of dimensions. Whereas we can *visualize* a three-dimensional cube intuitively, even with our eyes closed, this is not possible with a four-dimensional hypercube. Obviously, our spatial intuition is only adequate for three dimensions. Reconstructing the cube intuitively is thus quite feasible; the reconstruction of



A hypercube or tesseract such as this is a "generalization" of the common cube, just as the cube is a three-dimensional analogue to the common square.

a tesseract, however, can only be achieved with logical, mathematical or intellectual means.

Perception as Interpretation

The lesson of the cube is generally applicable: every perception is already an *interpretation* of sensory data. This interpretation can be difficult, impossible, ambiguous and even wrong. This can be shown with pictures with hidden objects, impossible figures, ambiguous drawings, optical and other illusions. All the same, such failures cannot disguise the fact that our perceptual mechanisms are generally quite reliable. Special attention, careful consideration and deliberate experiments are required to outwit them and make them give a false interpretation. Normally the reconstruction is perfectly correct.

A Projective Model of Cognition

As with the cube, we can interpret the relation between the real world, the cognizing subject and (presumed or genuine) cognition *projectively* in other cases, as

well. Real objects are projected – by light rays, sound waves, chemical substances, heat radiation or gravitational fields – onto our sense organs, most of them situated on the body's surface. Even such technical instruments for observation or measurement as telescopes, microscopes, thermometers, compasses or Geiger counters, only serve to widen this projection "screen," i. e., to translate incoming signals into stimuli which our natural apparatus can process.

In the cognitive process, we then attempt to reconstruct the objects from their projections. As every projection entails a loss of information, this information must be regained, at least partially, during reconstruction. Of course this reconstruction remains *hypothetical*. Thus, the projective model reflects an important result of epistemology and the philosophy of science: *all factual knowledge is hypothetical*.

Levels in the Cognition of Reality

If we accept the above explication, at least on a preliminary basis, at least three cognitive levels can be distinguished: perceptual, experiential and theoretical (or scientific) cognition. In perception, the internal reconstruction and identification of objects is usually *unconscious* and *uncritical* and usually cannot even be corrected. In experience, which includes linguistic formulations, simple logical inferences, observation and generalization, abstraction and concept formation, cognition is, in contrast, *conscious*, but remains uncritical. In science, finally, which avails itself of logic, the conception of models, mathematical structures, artificial languages, external data storage, artificial intelligence and instrumentally extended experience, the reconstruction is conscious and *criti-*

cal; however, the postulated structures often remain *non-visualizable*. For purposes, still another difference is of great importance: scientific cognition is a phenomenon of recent centuries or, at most, millenia; in contrast, perception and experience have existed for millions of years.

Is Epistemology Descriptive or Normative?

Our explication also reflects the doxastic character of the concept of cognition. "Cognition" designates both a process (cognizing) and its result (knowledge). But this is equally true for the concepts of "reconstruction" and "identification." They, too, stand for processes as well as for their results.

Epistemology as a "theory of cognition" has always tried to include both aspects. As a theory of the cognitive process it tends to be descriptive and explanatory; as a theory of knowledge it is rather descriptive and normative. Any attempt to restrict the role of epistemology to explanatory and normative tasks (or, even worse, the investigation of validity claims) and to discard everything else as "metaphysics of cognition" would not only exclude large areas of traditional epistemology (and certainly contrary to the intentions of the latter), but would also deprive us of the very instruments relevant to the clarification of cognitive claims. Admittedly, it is not possible to *infer* (epistemological) norms from factual knowledge (about cognitive systems), but *without* considering these facts it will be all the more impossible to solve epistemological problems. Precisely this empirical orientation, this coupling of descriptive and normative functions, this regard for the fact that has made such recent epistemology

structural approaches as Piaget's Genetic Epistemology, Chomsky's Universal Grammar, or Evolutionary Epistemology so fruitful.

How Does Cognition Come About?

This age-old question has been given many different answers. Since these answers often contradict one another, most of them must be wrong. (Every philosophy student ought to sit down and think about that!) However, it is neither the task nor the intention of this article to give an historical survey of epistemological positions. We can only sum up a few fundamental insights which have been significantly brought to bear on Evolutionary Epistemology.

Cognition comes about by means of the constructive cooperation of the cognizing subject and the object of cognition. The subject's contribution can be perspective, selective or constructive. Such cooperation only succeeds when both constitutive elements fit one another. This fit may be taken in a perfectly instrumental sense. Just as a key fits a certain lock (and not others), or as/and as a screwdriver is suited to being used with screws (but not with nuts), the structures of our cognitive apparatus fit a few objects of the real world (and not others). Thus, subjective and objective structures fit each other at least in the sense that *together they make cognition possible*.

This could be otherwise. It would be conceivable that there is no cognition, no cognizing beings, no cognitive achievements, no knowledge. It could be that all attempts to achieve cognition fail, that all tools of cognition are unsuitable. But this is not so: cognition exists. That is an empirical fact which Evolutionary Epistemology — like other epistemologies — is trying to describe and explain. The fact

that there is such a fit, is a *minimum requirement* for the realization of cognition.

Fits in Our Cognition Structure

This fit is not restricted to the dimensionality of the world and visualized space, it extends to many other structural characteristics of our perception and experience. It may indeed be difficult at first to designate such cases of fit. But they are easily found in any textbook of sensory physiology. To be sure, they do not appear under the heading of *fit*, but of *function*. But just as a tool only functions if and inasmuch as it fits the work piece, the eye, the ear, the sense of equilibrium, the brain only function because they fit the structural traits of the environment.

As evidence for this, usually properties of the human eye are cited: its sensitivity range lies in the optical window of the earth's atmosphere and around the maximum intensity of solar radiation, lower sensitivity threshold at the noise limit of the (statistically fluctuating) photon current, higher density of black-and-white-sensitive rods (for seeing in the dark), etc. But the same is true for all other channels of information.

The ear is particularly suited for hearing in air (and therefore not in water like that of fish). It allows for pressure compensation and covers broad ranges of frequency and intensity, its lower sensitivity threshold with regard to sound intensity lies at the informationless noise of Brownian molecular movement and of the blood stream; it identifies the direction and distance of the sound source, thus permitting spatial hearing.

Further examples are the subjective time quantum, subjective time perception (inner clock), the causal interpretation of sequences of events, the expectation of regularities, elementary inferences.

Spatial intuition involves astonishing reconstructive faculties. In a two-dimensional picture we see a three-dimensional

cube. In other instances, too, two-dimensional information from the retina is reconstructed as a three-dimensional object. However, we cannot visualize four-dimensional objects such as the hypercube. But indeed, there are no such objects in our world, either; this world and its objects are only three-dimensional. In this respect, our limited intuition and imagination are completely suited to the structure and demands of our environment.

Congruences

Moreover, in this and many other cases, there is even *congruence* between the world's structure and our subjective reconstruction: we experience the world three-dimensionally; and we know from physics that this interpretation is *correct*. Our experience of time imparts to us a profound difference between past and future; and physics teaches us that this time direction has *objective* character. (However, in contrast to our expectation, this is not due to the laws of nature, but to the initial conditions of the universe.) Subjectively, we give many sequences of events a causal interpretation, but not others; and physical analysis shows that there is *in fact* a difference between regular sequences of events and causal relationships: the transfer of energy.

However, it should be stressed that the fit mentioned above by no means *always* implies congruence. The (psychological, subjective) colour circle is closed and consists of quasi-discrete colours; the visible segment of the (physical, objective) electromagnetic spectrum, in contrast, is open at both ends, completely continuous, and does not contain the "invented" colour purple. Nonetheless, this, too, is an excellent and useful fit, as is the colour circle which, thanks to the principle of complementary colours, makes possible

colour constancy, i. e., the fact that changing light conditions macroscopic objects appear to us in the same colours that we can recognize them more easily. This example shows that no fit, no matter how good it is, guarantees the anticipatory su

Can This Fit Be Determined Without Circular Reasoning?

Isn't it naive realism to think the world three-dimensional because it *appears* to be so? We have no access to the world except via our perceptive apparatus. How then can we want to compare the world it is with the world as it appears to us? If we check a newspaper article, say, by comparing it with another copy of the newspaper?

But there is indeed an authority which can instruct us as to the structure of the world and corroborate or *correct* perceptions and experiences: scientific knowledge — in the case of dimensions primarily physics. It is true that for testing of physical theories we cannot without projection and thus without elementary means of cognition (this what makes them particularly important to epistemology). Just the same, we can articulate theories and, with our mesoscopic forms of intuition and our categories we can examine and corroborate them find them to be wrong) which contradict these very forms of human experience four-dimensional world models, Euclidean gravitational theories, non-normal quantum laws, theories without conservation laws, etc.

Some of these "paradoxical" theories have in fact proved successful, so that we are — for time being — willing to accept them as correct. Thus, the hypothesis that our world is in fact four-dimensional and that we only exper-

that des... three-dimensional projections of it, has been
oscopic frequently considered — without success. There
colours is no evidence that physical space has perhaps
more ea... four or more dimensions instead of three — no
contradiction in three-dimensional theories, no
fact that could be explained four-dimensionally
but not three-dimensionally, no better explanatory
success of a four-dimensional theory.

Without... That our world is spatially three-dimen-
he wor... sional and contains three-dimensional ob-
ppears to... jects, is thus an empirical fact suggested
o the w... likewise by our spatial perception and by
ratus. H... all pertinent physical theories. To this de-
he wor... gree we can indeed claim without resort-
s to us... ing to circular reasoning that our intuition
say, by... correctly reconstructs the three-dimensio-
of the s... nality of real objects. The same holds true
ority w... for all other instances of fit and con-
ecture of... gruence cited above. Of course, in this
correct : sci-... question, too, our knowledge remains
ensional... hypothetical, i. e. basically subject to cor-
: scien-... rection.

Where Do the Subjective Structures of Cognition Come from?

They can be innate or individually acquired. As a rule, it is indeed a matter of a complicated interaction of biologically given dispositions and environmental stimuli in which it is difficult to distinguish between genetic and environmental components. The example of the *imprinting* of new-born animals may be mentioned here: the gosling is genetically programmed to learn to recognize its mother in a definite sensitive phase after hatching. The imprinting occurs by the first object that comes along which fulfills certain minimum requirements, which moves, for example, or answers the contact call of the young bird. The cognizance of the mother animal is then neither instinctive nor acquired, but is achieved by an intertwining of a genetic programme with environmental data.

Man, too, has numerous cognitive structures, mechanisms of reckoning, algorithms, abstraction procedures, methods of inference, learning programmes, language-acquisition mechanisms, expectations, dispositions, pre-judgments about the world, which are either genetically pre-programmed as a whole, or — and that is presumably the rule — which *mature* according to a genetically determined programme and are dependent on certain environmental data (such that when such stimuli are lacking they can also atrophy).

Innate Cognitive Structures

To illustrate this, a few empirical results may be cited. Innate to man are not only the ability to suck, grip, and stride, smiling and the mimicry of rage, but also motion vision, colour perception, and a sense of time. Innate is spatial vision, i. e., the ability to interpret two-dimensional retina images three-dimensionally, and an aversion to depth. Innate are above all the achievements of constancy, enabling us to recognize objects, to "objectify" the world, to abstract, to form classes and concepts. Innate is the knowledge of human faces (not just of a single face), the visual fixation of a source of sound (even in children born blind!). Innate are the ability to use language and the need to speak, possibly a few fundamental grammatical structures, as well ("universal grammar"). Partly innate are intelligence, musicality, logical structures, e. g., the modus ponens ("if A, so B; now A, therefore B"), biologically realized by the ability to develop conditioned reflexes; elementary mathematical structures, for instance group structures and formation of invariants, possibly causal perception and causal thinking, as well.

The rationalists' and "nativists'" search for "innate ideas" was thus perfectly justified. But not until our century was it possible to specify more precisely what is meant by "idea" and "innate" to a degree enabling an empirically verifiable answer.

It would in any case be completely inappropriate to regard the brain at birth as a tabula rasa or even simply as a computer which is only gradually programmed. Rather, most of the programmes are well installed by the time of birth; the subsequent individual experience merely provides sub-programmes and differing data.

As stressed above, this of course does not mean that all our knowledge is innate. Nor does it mean that all the environmental information that we bring along at birth has to be *correct*. But under normal conditions our innate expectations regarding the environment are in fact quite useful (they "fit") and often even correct (or "congruent").

How Does This Fit Come About?

For every tool there is someone who makes it, picks it out, uses it. Could this also be true of the human cognitive faculty? Can we understand the function and fit of our cognitive apparatus only by making a creator responsible for it? But how else can it happen that the subjective cognitive structures which we bring along fit reality so well and in part are even congruent with it? How can we explain, Kant also asks, that the use of the categories "precisely agrees with the laws of nature, in accordance with which experience makes its way" (*Critique of Pure Reason*, A 1781, B 1787, B 167-8); and he is surprised at "this harmony of nature with our cognitive faculty" (*Critique of Judgment*, 1790, A XXXIV).

This typical epistemological question is answered by Evolutionary Epistemology: our cognitive apparatus is a result of biological evolution. Our subjective cognitive structures fit the world because they have evolved in a process of adaptation to this world. And they are (partially) con-

gruent with real structures because such congruence made survival possible. They are individually innate and in a sense *ontogenetically a priori*, but were acquired in phylogeny by the species and are thus *phylogenetically a priori*.

Traits of Evolutionary Epistemology

The existence and thus the possibility of cognition is an *empirical* fact. Fit, partial congruence between subjective (and in part innate) cognitive structures and objective structures — where they exist — are also empirical facts. These facts can be explained by Evolutionary Epistemology. A person who recognizes the facts but rejects Evolutionary Epistemology is challenged to supply a better explanation.

The history of philosophy shows that the fit mentioned above was seen as taken seriously as a problem. The solutions range from rationalism to empiricism, from pre-established harmony (Leibniz) to occasionalism (Geulincx), from transcendental philosophy (Kant), from transcendental linguism (Wittgenstein), from conventionalism (Poincaré), from economism (Mach). The answer of Evolutionary Epistemology is not identical with any of them. But of course it owes much to its predecessors, particularly to the philosophy of Kant.

Evolutionary Epistemology interprets the *fit* of our cognitive structures as a result of a process of selection, of an evolutionary adaptation. Not only are the sensory organs, the central nervous system and the brain, products of evolution, with their functions, as well: seeing, perceiving, judging, cognizing, inferring. By this the field of epistemological research argumentation is significantly broadened. Whereas the object of study of traditional

epistemology was intended to be the cognition of every "finite rational being," but in fact only that of the *normal, adult, educated European*, Evolutionary Epistemology encompasses many further aspects:

- the individual differences within a human population with the entire range of genetically determined characteristics;
- the differences between human races;
- the cognitive development in the growing child;
- the phylogenetic origins of the human cognitive faculty.

Evolutionary Epistemology is not a discipline of natural science. But it answers epistemological questions via a theory of natural science, the theory of evolution. That alone should be no cause for alarm; after all, in the course of the history of philosophy, this has happened frequently. In the case of Evolutionary Epistemology, however, such a procedure is at times considered *circular*. And indeed, epistemology and empirical science do have a certain reciprocal relationship. But a vicious circle would only be given if Evolutionary Epistemology claimed to provide an *ultimate foundation* for empirical cognition. In fact it is a *virtuous circle*, a productive, self-correcting feedback structure which is neither tautological nor inconsistent, i. e., neither empty nor contradictory.

Evolutionary Epistemology indeed has markedly pragmatic traits, but it does not expound a *pragmatic concept of truth*. Evolutionary success can neither define nor guarantee the truth of our innate hypotheses. Evolutionary Epistemology even points to such counterexamples as the *color circle*, which is highly adaptive and yet "freely invented." It is thus far from confusing genesis and validity. How, then, does it solve "the" validity problem? If

validity means absolute validity, it does not solve it; for then it cannot be solved at all. But if also relative (e. g., hypothetical) argumentations, justifications, proofs are allowed, then Evolutionary Epistemology does certainly contribute to that discussion. To be sure, evolutionary success does not prove that all our innate hypotheses are true, but it does show that they cannot be all wrong.

Prerequisites of Evolutionary Epistemology

Evolutionary Epistemology is not a comprehensive epistemology. Before it can even be articulated, a few preliminary questions must be settled. We need, first of all, explications of the concepts of "cognition," "truth," "objectivity" (cognition is explicated as an appropriate [internal] reconstruction and identification of external objects, hence truth in the sense of the correspondence theory); second, a theory about how cognition comes about (via an interaction of objective and subjective structures); third, a theory on the relationship between the real world and the cognizing subject (this task is performed by the projective model); fourth, assumptions concerning the relationship of consciousness and the brain (an identity theory based on systems theory); and fifth, factual knowledge about the existence, range, and fit, of cognitive systems with subjective cognitive structures (as provided by psychology, physiology, neurobiology, evolutionary theory, ethology, linguistics, and other disciplines of empirical science).

The preconditions of Evolutionary Epistemology include in particular *hypothetical realism* (which is not significantly different from critical or scientific realism). Its fundamental assumptions are: the hy-

pothetical nature of all factual knowledge; the existence of a world independent of our consciousness, structured by laws, and contiguous; and the supposition that this world can in part be known and explained by perception, thought and an intersubjective science.

Within the projective model as sketched, not only can various levels of cognition be distinguished; the special task of Evolutionary Epistemology can also be elucidated therein. Above all, it centers on the *cognitive apparatus* onto which the projection is made and which then tries to reconstruct the real structures from the projections. It explains its successes and failures, its range and its limitations. In the process, Evolutionary Epistemology takes recourse primarily to perception and experience and only occasionally to scientific knowledge.

Since cognition is regarded as a function of the brain, Evolutionary Epistemology from the very beginning takes up position in the mind-body controversy on the side of an *identity theory* and thus pursues a consistently naturalistic approach. From a dualistic viewpoint, to be sure, one could refer to an "evolution" of conscious phenomena as well. However, its relationship to biological evolution would then be at best a coincidental analogy (selection can only be effective with material systems); this would not really *explain* the fit in question.

Of course it is possible to include the entire preparatory context (realism, projective model, identity theory) in Evolutionary Epistemology and to call this comprehensive viewpoint "Evolutionary Epistemology." But nothing would be gained by that. It would be far more likely to produce confusion, as evolution is not relevant for all parts of this broadened scope.

The Role of Evolutionary Theory

- The theory of evolution is also an indispensable prerequisite of Evolutionary Epistemology; it even gave it its name. However, Evolutionary Epistemology does not depend on every detail of the theory of evolution; but its validity vitally depend on the following principles:
 - the *common origin* of most, if not all, organisms on earth,
 - the *phylogenetic kinship* of man with animal ancestors, especially with primates,
 - (almost) *invariable reproduction* of organic systems,
 - *inheritability* of anatomical, physiological, behavioural and cognitive characteristics,
 - diversity of organic types through mutations,
 - differential reproduction due to differing competence, usually called "*natural selection*" (or "survival of the fittest"),
 - evolution as a process of development and adaptation.

That there are further evolutionary factors, such as isolation, occupying a niche, genetic recombination, may indeed be important to Evolutionary Epistemology, but is not crucial. Evolutionary Epistemology would lose its thrust, however, if one of the cited principles of evolutionary theory were false.

In spite of this strong dependence, it would be wrong to consider Evolutionary Epistemology a part of evolutionary biology. Whereas the theory of evolution is exclusively biological and thus scientific, Evolutionary Epistemology, apart from its descriptive and explanatory elements, also contains explicative and normative ones which characterize it as a metascientific discipline. Thus, it far exceeds being a mere "biology of knowledge."

ory (Riedl) or a "biology of cognition" (Matu-
rana).

How Should Epistemologies Be Assessed?

The ontological, epistemological and empirical premises cited — hypothetical realism, projective model of cognition, identity theory, evolutionary theory — are at least in large part constitutive to Evolutionary Epistemology. Without them, the latter can neither be articulated nor sustained. On the other hand, Evolutionary Epistemology supports these prerequisites. This relationship is not a vicious circle, as no final proofs are intended or claimed. It merely reflects the hypothetico deductive structure even of epistemology.

Evolutionary Epistemology can succeed or it can fail. If it proves itself, this success will provide good arguments for its premises. It must not only prove itself in the face of logical analysis and empirical facts; it must also prove itself by answering questions, solving problems, contributing to the explication of epistemological concepts, recognizing new problems and helping in articulating them, etc. "Ye shall know them by their fruits!" Apart from its inner consistency and compatibility with empirical background knowledge, it is above all its *problem-solving potential* by which an epistemology should be measured.

Evolutionary Epistemology can face the challenge of these assessment criteria without qualms. Intrinsic contradictions have thus far not been found. Its consistency with science is not even disputed by its critics (it rather aroused the suspicion that it is an empirical discipline). Its problem-solving potential can admittedly not be presented in a few words. But we can try to summarize a few questions and

answers. The topics which have been raised are almost entirely of an epistemological nature. This in itself is an implicit proof that Evolutionary Epistemology — contrary to the suspicion of a few critics — is in fact epistemologically relevant.

Answers of Evolutionary Epistemology

What role do the subjective cognitive structures play? They are constitutive for cognition, they make cognition possible. Where do they come from? Some of them are innate and are thus results of biological evolution. Why are they (nearly) the same with all people? Because they are in part genetically conditioned and hereditary. Why do subjective structures (of cognition) fit objective structures (of the real world) and are in part even congruent with the latter? Because otherwise we wouldn't have survived evolution. Why is human cognition not ideal? Because biological adaptation never is.

How far does human knowledge extend? First of all, it is adequate for survival, i. e., inasmuch as it is genetically conditioned (perception and immediate experience), it fits the world of medium dimensions, the mesocosm; but it can reach beyond and does just that, primarily as scientific knowledge.

Can intuition serve as a criterion of truth? No, our intuitive faculties are adapted to the mesocosm; beyond, non-intuitive theories can be perfectly correct. Can agreement with our categories serve as a criterion of truth? The answer is likewise no.

Is objective cognition possible? Yes, it probably even exists. Is intersubjectivity a sufficient criterion for objectivity? No, there are also common errors. Is there a necessary criterion of objectivity surpassing intersubjectivity? A reasonable cri-

rion of objectivity is *invariance*, i. e., independence from changes in the conditions of observation. Is there a sufficient criterion of objectivity? No, our knowledge is hypothetical on this question, too. Are there limits to human cognition? Yes, even if we had achieved objective knowledge, we could never be absolutely sure of its truth or objectivity. Is there a priori knowledge of the world? If "a priori" means "independent of all individual experience," yes; but if it means "independent of *any kind* of experience," no; if it means in addition "absolutely true," no. Are there, then, synthetic judgments a priori in Kant's sense? No.

Demarcations

Evolutionary Epistemology does not claim that all knowledge is genetically (biologically) determined. Cognition is rather biologically *conditioned*, but only in part biologically determined, viz., in perception and experience. Our brain indeed did evolve not as an organ of cognition, but rather of survival. But it is in fact capable of more. It enables us to form hypotheses and theories which go far beyond the mesocosm for which it is originally selected.

The decisive step in this was the breakthrough to a descriptive and discursive language. Just as we can construct, execute and evaluate *trial actions* in our imagination before we really act, thus saving time, energy, and risk, we can also *articulate* completely counter-intuitive facts with the aid of language, we can *assume* them for the sake of experiment and *examine* their inferences without having to think they are all true. And thus — quite unlike organisms without language — we can let our theories die in our stead (Popper).

To be sure, the origin of language and the human faculty of speech is biological, relevant and of crucial importance and significance for the evolution of man; but every use we make of it can be explained by evolution. Scientific cognition, from the standpoint of biology, is a *by-product* of such general abilities as abstract generalization, concept formation, logical inference. It would be pointless to try to excavate the biological roots of the theory of relativity, of quantum chromodynamics or molecular biology; they don't exist. It is possible and meaningful to study cognitive failures as to their biological mesocosmic origin.

Why is it so hard for us to estimate the long-term growth of capital with compound interest? Why do we have no feeling for the hyper-exponential growth of mankind on our globe? Why do we fail in dealing with interconnected systems? Why do we have so little insight into systems with positive feedback? Why are we best capable of linear extrapolation? Why do we expect some kind of compensatory justice in games of chance? Why is it so hard for us to adjust to chance events? Why are there often such big differences between objective and subjective criteria of decision? Why could Aristotle's theory of motion and the medieval impetus theory be accepted for so long? Why can't we visualize non-Euclidean spaces, four-dimensional cubes, a finite but limitless cosmos, absolutely accidental events?

In the strict sense of the word, "biology" means "the biology of men." Just as philosophy has applications in the psychology of research, in the explanation of the history of science, in didactics, in anthropology. For reasons of space, we cannot expand these far-reaching consequences here.

In spite of its applicability to the history of science, Evolutionary Epistemology should not be mistaken for an explanatory model of theory dynamics. It is concerned

with the evolution of cognitive faculties, not with the evolution of scientific knowledge. The way theories are devised and tested, corroborated or refuted, corrected or superseded, is not a problem of Evolutionary Epistemology, but of philosophy of science. There are at best analogies or structural parallels to Popper's or Toulmin's "evolutionary" methodologies. They are instructive, heuristically valuable, dialectically helpful, but that doesn't mean they are identical. Popper's doctrine of three worlds, in particular, is incompatible with Evolutionary Epistemology.

The relationship of Evolutionary Epistemology to sociobiology should at least be touched upon. They have the reference to biological evolution in common. But they are concerned with completely different questions: "What can we know?" on the one hand; "What should we do?" on the other. The subject of Evolutionary Epistemology is our cognitive capabilities; the subject of sociobiology is our social behaviour. In both cases, the question can be raised as to their evolutionary origin, as can that of *philosophical consequences*, in the first case as regards epistemology, in the second, ethics. Evolutionary Epistemology and sociobiology thus form an heuristically productive analogy, but not of a logical implication.

In the strict sense, sociobiology is first of all a "biology of social behaviour (of animals and men)." Just as Evolutionary Epistemology philosophically expands the "biology of cognition" to an epistemological theory, sociobiology may be expanded by a future "evolutionary ethics" to a philosophical discipline. However, the field of study of such evolutionary ethics will be completely different from that of Evolutionary Epistemology.

Finally, what is true for cognitive structures and social behaviour, is also true for the evolution of aesthetic judgments: at first, it will be limited to description and explanation, but then

an attempt will be made to draw philosophical conclusions. But here there is as yet not even a "biology of art", so that *evolutionary aesthetics* cannot even begin to be taken up.

Evolutionary Epistemology as an Unfinished Task

Evolutionary Epistemology claims to provide answers of its own to old and new problems. It should be no surprise that in the process it comes into conflict with traditional views. It is thus the task of its proponents and critics alike to examine positions and arguments by making critical comparisons. They can stress the common aspects or the differences. For reasons of space, neither could be done in this presentation.

However, Evolutionary Epistemology is not a complete theory. It is rather a research programme. There is still no complete system of the categories of human experience which is supported by biology and psychology. (Kant's system is certainly *not* adequate in this regard.) There has still been no study of the restrictions to which all empirical cognition is subject due to the projectability postulate, i. e., due to the fact that objects can only be recognized if they *somehow* enter into causal correlations with us. There is still no thorough comparison with transcendental philosophy, with logical empiricism, operationalism, constructivism, pragmatism (there are close relationships in each case). There is no analysis of the feedback between scientific knowledge and epistemology, so important from an historical and systematic point of view. There are as yet no empirically testable and tested hypotheses on the actual evolution of human cognitive abilities.

There is as yet no evolutionary psychology making the concept of evolution productive for psychological problems, as

well. There is no evolutionary theory of education, which doesn't "instruct" or "programme" the child as a *tabula rasa*, but challenges and promotes its natural development. There is no evolutionary didactics replacing cumulative learning models by a contrasting model enabling mesocosmic prejudices to be recognized, discussed, and surmounted.

Such efforts would not only have Evolutionary Epistemology to thank for some ideas, but would also on their part have productive and corrective effects on Evolutionary Epistemology. In any case, there are still many opportunities for scientific and philosophical research.

English translation by Philip Mattson

Bibliographical References

- Vollmer, G.: Evolutionäre Erkenntnistheorie ("Evolutionary Epistemology"), Stuttgart 1975, 5th edition 1990. — Vollmer, G.: Was können wir wissen? ("Can We Know?"), vol. 1: Die Natur der Erkenntnis. Beiträge zur Evolutionären Erkenntnistheorie ("Nature of Cognition: Contributions to Evolutionary Epistemology"), Stuttgart 1985, 2nd edition 1988; vol. 2: Die Erkenntnis der Natur. Beiträge zur modernen Naturphilosophie ("The Cognition of Nature: Contributions to a Modern Philosophy of Nature"), Stuttgart 1986, 2nd edition 1988. — Vollmer, G.: Wissenschaft mit Steinzeitgehirnen? ("Science with Stone-age Brains?"), in: Mannheimer Forum 8, Mannheim, p. 9 - 61.

Consciousness and the Conquest of Pain

Oriental Wisdom and Scientific Knowledge

Klaus Jork, Frankfurt on the Main

Even interdisciplinary treatment in pain centres of patients with chronic pain often gives only unsatisfactory and short-term results. More recent concepts therefore aim at active strategies to overcome pain in collaboration with the patient. These include pain concepts from the psychology of learning and may also employ the methods practised for centuries by Tibetan Buddhism.

2. *Openness*, i.e. I do not reject as a matter of principle what is strange.

3. *Tolerance*, i.e. I recognize the validity of strange opinions, even if I do not understand them at once.

4. The ability to *question*, i.e. I am prepared to examine the views I have held till now and to correct them if necessary.

Everyone looks for happiness, or at least for freedom from suffering such as from pain. At the same time we seek security and constancy. Mostly we do not attain these goals for long. According to various estimates there are at least three million people in Germany alone who suffer from chronic pain.¹

We can be thankful that many of us have been spared the syndromes of chronic pain till now. Here then we will deal with a symptom that is largely strange to us and also with how various situations in life are seen by oriental philosophies. These ideas are strange to us and to examine them and the methods derived from them we need:

1. A certain *curiosity*, i.e. I am curious about things about which I know little as yet.

Professor Klaus Jork, born in 1937 in Dresden, studied Medicine in Berlin and in Mainz. After taking his doctorate, scientific assistant in the Departments of Physiology and of Pharmacology and in the Neurosurgical Hospital of Mainz University.



In practice for two years. From 1970 general practitioner in Langen. 1974 / 75 Lecturer in General Practice at the University of Frankfurt. From 1979 Director of the Department of General Practice. 1981 Professor for General Practice. Main areas of work: patient – doctor relationship, self-medication, medical decision taking, health advice and practice-related medical education.

Prof. Dr. Klaus Jork, Institut für Allgemein-medizin, Klinikum der Johann Wolfgang Goethe-Universität Frankfurt, Theodor-Stern-Kai 7, 6000 Frankfurt on the Main/Germany

Pharmacotherapy - a Pillar of Pain Treatment

Even today pharmacotherapy is a pillar of pain treatment.² With this are understood psychoactive drugs, particularly antidepressives, neuroleptics and tranquillizers, spinal analgesia with opiates, also corticoids and ganglionic blockers. Other possibilities are offered by blockade of the nerves with local anaesthetics or by neurosurgery in the peripheral or central nervous system, by electrostimulation, or by neuro-orthopaedic and physical treatment, including acupuncture. Acute pain functions as a signal. On the other hand chronic pain means disability and demands a differentiated and often multidimensional strategy to overcome it. With our externally orientated understanding of life, psychological techniques and strategies better to overcome the burdens of illness³ and to learn to live with pain⁴ are only slowly winning acceptance. They require much expenditure of time and are not well known among doctors.

How Pain Is Seen Behaviour During Pain

The reactions of living creatures, including man, were seen for a long time as a multitude of simple cause-effect relationships. This one dimensional way of looking at things was attempted both for disease and for pain, the origin and transmission of which were thought to be due to specific pain pathways and centres in the brain and spinal chord. Only the Gate-Control Theory of Melzack and Wall⁵ caused a change in the paradigm, which is also being increasingly recognized in the medical world.⁶

According to this, "health" and "disease" are descriptions of the state of a

complex interactive system comprising body, psyche and social environment.

Pain relief was foreign to European cultures up to the Middle Ages and the reasons for this can be made out.⁷

1. For man pain means a damaged open, man These the

verse and has thus a cosmic and my pain and requests f

2. Pain is a sign of decay in na With "c Think for instance of the pain of arth stands fo

during progressive decay of the knee pain, non behaviour"

of lack or evil, was an aspect of the so thought,

Only after the separation of body and soul by Descartes could pain be regarded as a self-defense signal of the body signs of g

at preserving human integrity. Thus p

was a warning to take on active respons

ability for suffering. These

of learning

The misuse of analgesics and other operant p drugs in pain treatment ascribes the reaction of a passive recipient of treatment to the patient. This also hinders individual damage control, as in changes in behaviour or tenseness of the environment in reaction to pain, or sider pain autonomic self-regulation. The deleterious effect on the organs remains.⁸

Since 1977 attempts have been made and use behavioural science and techniques shown f the treatment of pain, particularly chronic analgesic pain, in accordance with a multidimensional professional understanding of the phenomenon. In pain perception distinctions are made between sensory, affective-motivational and cognitive processes. The basic idea here is that disease or pain behaviour quite directly influenced by the consequences.

Concepts of Pain in the Psychology of Learning

Since it has been recognized that deal with pain is greatly dependent on cul

comprise, attention and interpretation, differentiated models of pain behaviour have been developed.⁹ Thus the *trimodal model of pain behaviour* distinguishes between open, masked and psychological reactions with different levels of behaviour. These then determine behaviour, both in pain and in health.

With "open pain behaviour" one understands for example complaints about pain, nonverbal mimic reactions or verbal requests for analgesics. "Masked pain behaviour" means subjective events, such as thought, phantasies or feelings. "Psychological pain reactions" mean a variety of autonomic, pyramidal and extrapyramidal signs of general hyperactivation.¹⁰

These pain concepts from the psychology of learning are further differentiated by an operant pain model. According to this a reaction to pain (respondent pain reaction) can be seen in effects which are damaging to the body, such as muscle tension. This model then does not consider pain in itself, but positive or negative consequences coming from pain behaviour, which then influence the duration and intensity of the pain. It can be shown for example that treatment with analgesics increases the frequency with which pain occurs. This principle of positive reinforcement means that pleasant or desired reactions take place when pain occurs. Negative reinforcement occurs, as a secondary positive effect of disease, when for instance unpleasant effects do not occur when reactions to pain are conveyed. On the other hand, and in the sense of a learning model, observations of the social rewards of excessive pain can excite or reinforce new ways of behaviour. Thus children in so-called "pain families" suffer significantly more frequently from pain than do control groups.

Reality and Consciousness

The above discussion makes it clear how difficult it is to objectify and to measure pain. However scientific research demands objectifiability, verifiability and reproducibility. There is then a contrast between this effort of uninvolved and objective observers and the subject, who experiences pain himself. The question arises of the truth or reality of the experience of pain.

Pain is in the patient; it is not visible, not demonstrable and can only be examined to a limited extent. Is it "real"? As the roots of psychological pain treatment are frequently to be found in the methods and practices of the cultures of the Far East, it is legitimate to discuss the origin of reality as seen in Buddhist philosophy. The basic idea in Tibetan Buddhism is that we do not experience the world as it is, but as how we imagine it according to the impressions given by our senses.

How Does Reality Arise?

According to this philosophy our perception of reality is a result of five groups, known as skandhas, visual strengths or appropriation groups, which form our empirical personality. The appropriation group *body* (*rupa*) signifies the physical body of man, consisting of bones, muscles, flesh and skin. This is the foundation of the following four groups or components of the personality, which form a conditional sequence and which represent the perceptual theory of Buddhism.¹¹

Sensations (*vedana*) and *feelings* are the second group and they are the result of the contacts of the sensory organs with objects in the environment, which is equivalent to sensory stimulation or impres-

sions. In the brain of the subject these are then converted to reflections of objects, to *perceptions* (*sanna*), which make up the third group. The experience of human socialization then converts these to *mental impulses* (*sankhara*), the *will*, or phantasies, wishes and desires. The essential thing about this fourth group, these mental impulses, is that they press for their own realization. That which is imagined, such as intentions, drives, phantasies and creativity, includes the aim of converting itself into reality. Thus the mental impulses motivate or initiate our actions.

The fifth group is *consciousness* (*vinnana*) and this arises from the sensations, perceptions and mental impulses as a developing consciousness of what is perceived: "That which is sensed by the eye, hearing or sense of smell etc. becomes an object which is illuminated by the light of an alert mind and which can then be used as a basis for mental processes."¹² From this philosophical understanding the personality can be described exclusively in terms of these five groups.

None of these five groups - neither sensation, perception, mental impulses nor consciousness - is durable and of independent "reality". They are subject to the law of transitoriness and thus also to the person who consists of them. Transitoriness, ability to suffer and non-selfhood (which means only conditional reality) are the three characteristics of the individual in the world according to Buddhist philosophy. Suffering arises from the phenomena of birth, illness and death. Suffering also includes desire and antipathy, such as separation from the loved, or association with the unloved and the experience of pain. Here then we see a pragmatic approach which is also valid for the methods of behavioural therapy. The circumstances do not determine the happiness

or unhappiness of man, but his spiritual ability to overcome the circumstances.

Psychological Possibilities for the Treatment of Pain

In the German language literature there are firstly textbooks on the symptom pain in which the concepts for medical treatment are mostly physiological or pharmacological based.¹³ The pragmatic application of scientific knowledge dominates above all. Other books¹⁴ emphasize studies in psychology of learning or in neurophysiology. These underline the possibilities of controlling pain by relaxation techniques and by therapeutic intervention at the cognitive or behaviour levels.

Science is a necessary but not adequate basis for medical treatment.¹⁵ Experience too is a necessary but only conditionally reliable basis. One can then infer that science and experience only together can play a complementary role in medical treatment. One-dimensional strategies prove to be inadequate for overcoming the strains of illness¹⁶, particularly chronic pain. "Overcoming" understood here as a perpetually changing cognitive and behavioural effort which has to prove itself against specific internal and external claims. This definition is thus more process orientated than related to characteristics. Possible ways of overcoming pain could be (with examples):

- *Confrontational coping*: I accept the pain, assert myself and fight for its reduction.
- *Distancing*: I notice the pain, but behave as if it were unimportant.
- *Self-Control*: I attempt to keep my sensations to myself.

- *Striving for social support*: I speak with someone who can do something concrete about the pain problem.

- *Taking on responsibility*: I criticize my sensitivity to pain and reproach myself.

- *Avoidance of flight*: I wish the pain would stop.

- *Planned problem solving*: I develop sensible steps to fight the pain.

- *Positive re-evaluation*: I alter my attitude and point of view.

Problem or emotion directed strategies for overcoming pain can be seen in all the above possibilities. The former demand for example a change in the environment or in one's own behaviour. To the latter belong purely cognitive activities, i.e. concepts for learning, which alter the perception of relationships.¹⁷

relaxation aim for developing consciousness of the body, the breath, the senses and the thoughts²⁴ and thus allow an influence on the pain syndrome. In this way they simultaneously cover several of the eight methods described above for overcoming pain. An initially passive attitude of caring for pain can thus be replaced by active strategies for overcoming it, and which militate against its somatic fixation²⁵.

Sternbach²⁶ has developed a *therapy concept in seven steps*, through which the patient learns to live with pain, although it hurts. The most important step is the *acceptance of pain* "and that he (the patient) does not lie to himself". The *setting of goals* in the contexts of work, hobby or social life is then just as important as the conversion of *rage* into motivating energy. A *set time-table for activities* is meant to stop the pain being used as an excuse. *Daily physical training* helps the *learning of relaxation*. All these measures are most likely to succeed with *support from the family*.

In the last few years *visualization* has also been employed in psychological methods of pain treatment. Relaxation comes normally from sleep or movement. The results of recent research indicate that it is also possible to control the visceral nervous system and achieve a *harmonization*²⁷ through deliberate relaxation when conscious, that is for example by meditation, autogenic training, self-hypnosis or progressive relaxation and visualization.

"If We Make Ourselves a Picture"

Visualization as a pictorial imagination of events can lead to an alteration of expectations in human life²⁸. "When we imagine a picture we say something about

Healthy Living, Relaxation and Visualization

The methods and practices of Tibetan Buddhism for the conduct of life are also derived from the Indian *Ayurveda*, the science of the healthy life.¹⁸ *Ayurveda* is thus not only a form of medicine, as often thought in the West. The central component is the teaching of the Marmas, the sentry and warning points in our bodies. A central significance in pain treatment is ascribed to rhythms and to life events, as aspects of time.

The behavioural therapeutic techniques of Western medicine are practised as learnable concepts in cases of chronic pain¹⁹ and include *relaxation techniques*²⁰, vasoconstriction training in migraine and techniques of directing attention and of restructuring cognition²¹. Comparable techniques are learnt in yoga schools, which either concentrate on respiratory training²² or include other physical expressions and functions²³. The stages of

our wishes. If we repeat this often enough we come to the definite expectation that our wishes are becoming real." Positive expectations can help us to achieve a way of behaviour which is conducive to the realization of what is desired. Visualization can be employed both in pain treatment and in cancer.

The first steps in the relaxation phase in visualization are the consciousness of respiration and the concentration on the parts of the body. In the meditation of Tibetan Buddhism there then follows concentration on non-material processes in the body and a turning away from external events: "We feel the shapeless stream of air which comes and goes on the tip of the nose; we let thoughts and noises simply pass us by, without clinging to them..."

Visualization Practices

Visualization practices for coping with chronic pain consist of three phases:

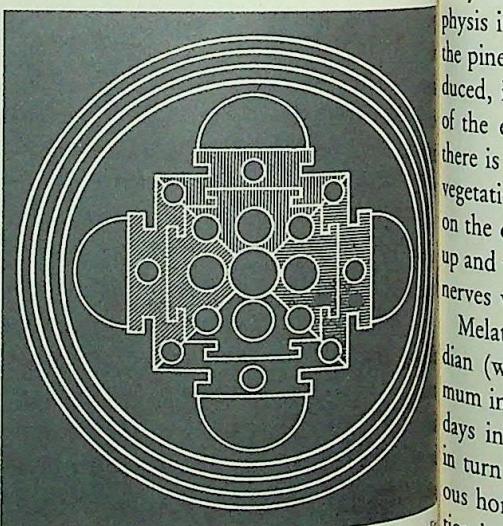
- The visualization of the *healing strength* of the body, for instance the resistance of the leucocytes and their help in the painful part of the body.
- The *discourse* with the pain, for example after imagination of a pain entity. You ask what you can do to be rid of it.
- The *visualization of the pain*, for instance as a ball which changes its size and colour.

Another possibility of treating pain is that patients deliberately devote themselves to activities which they enjoy. They imagine again and again that their complaints are reduced or even disappear. They replace pain with joy.

Visualization has a central role in various practices of Tibetan Buddhism. Here too it is suited to disarm disturbing influences and to lead to synchronization in the body. Buddhism sees man both as a

microcosmos and as an image of macrocosmos. One symbol and help in meditation in this system is the *Mandala* ("circle") which is a representation of cosmic forces in a systematic two or three dimensional form. The points of the compass and the zenith and nadir serve orientation in a spiritual world and the presentation of a way to grace. The *unary approach* is emphasized in the Buddhist rituals through *postures (mudra)*, *consequences of syllables (mantra)* and meditation in the *symbol of the cosmos, the Mandala*. Postures, syllables and Mandala respond to action, communication and thought, respectively. However oriental philosophy sees the concept of "unity" only theoretical, if it does not include orientation to sense and goal of human existence.

A technically demanding pictorial procedure, positron emission tomography (PET), permits documentation of metabolic processes in the body. This



Schematic construction of mandalas as a help to meditation. The meditator passes through the outer three rings symbolizing purification (circle of flames), initiation (Vajra circle) and transmutation (Lotus circle). He enters the palace with the earthly Buddhas through one of the four gates with their guards. After his maturing and with the help of a transcendental Buddha he reaches the inner sanctum, to attain mystic union with the mæval Buddha through knowledge of the void.

reactions in the brain, graded according to intensity. We possess no pain centre in the central nervous system. It is much more the case that, in accordance with its perceived intensity, pain causes ganglionic reactions throughout both hemispheres of the brain. With the help of PET it can be demonstrated that modification of behaviour during pain can lead to a reduction of the pain experienced. However, before every psychological therapy of chronic pain it must be clarified whether the chronic pain is caused by a change in pain perception or is affected by maintenance of pain behaviour, such as muscle tensionness.²⁸

Scientific Knowledge and Overcoming Pain

In recent years scientific studies have increased the understanding of complex metabolic phenomena in the human body. Thus we now know that the epiphysis in the brain is an endocrine organ, the pineal gland. In this melatonin is produced, in dependence on the stimulation of the eye by light. In the middle brain there is thus a direct effect on autonomic vegetative function which is dependent on the quality and quantity of light taken up and which is dependent on those optic nerves which are sensitive to energy.²⁹

Melatonin secretion has a marked circadian (within day) rhythm, with a maximum in the night. The lengthening of the days inhibits melatonin secretion, which in turn increases the production of various hormones and thus influences ovulation in many animal species.

The sensitivity of man to pain is also subject to a marked circadian rhythm, as can be demonstrated in the duration of action of local anaesthetics in dental practices. It is presumed that circadian differ-

ences in transmission of or sensitivity to pain are responsible for this.³⁰ Within the daily rhythm the total duration of activity of a local anaesthetic is at its maximum at 2.00 p.m. and at its minimum at 5.00 p.m. An endocrine signal can transmit the photoperiodic exposure to light and dark to various areas of the brain and to peripheral organs of the body.³¹

Atrophied Introspective Abilities

In Western cultures we approach the question of mastering life predominantly from a rational point of view, either on the basis of natural science or of the arts. Traditional Asiatic cultures approach everyday problems from an empirical and pragmatic point of view, based on subtle observation, perception and didactic transmission over centuries. We have largely lost such abilities, not least because of exaggerated belief in science since the end of the 19th century, which has permitted the atrophy of our abilities of observation and introspection. In our world, which is orientated towards externals, we only allow the validity of what we can measure, weigh or count. We admittedly all have dreams and experience, phantasies, creativity and fears. But only a few of us learn how to shape our internal life with consciousness as an instrument, and thus to achieve clarity.

I have hoped to make clear in this article that the symptom chronic pain causes sensory, affective-motivational and cognitive processes in man. Pharmacotherapy and surgical interventions have therefore only restricted ability to treat pain. Applied psychological or behavioural therapeutic strategies have been used in the West for overcoming pain for only a few years and are based on oriental philosophy. Only if I consciously accept pain

I can deal with it. The perspective on life of the Buddhists is to accept pain and then to control its effects with the consciousness. Concentrative meditation and visualization have been practised for centuries in Tibetan Buddhism and in Indian yoga. These can influence complex metabolic events in the human body which are increasingly being understood by natural science.

English translation by R. A. Yeates

- ¹Keeser, W.: Pain . (Schmerz.) In: R. Asanger/G. Wenninger: Encyclopaedia of Psychology. (Lexikon der Psychologie.) Munich, Weinheim 1988; Zimmermann, M./Seemann, H.: Pain - A Neglected Area of Medicine? (Der Schmerz - ein vernachlässigtes Gebiet der Medizin?) Berlin, Heidelberg 1986. -
- ²Zimmermann, M./Seemann, H.: Ref. 1. - ³Lazarus, R. S.: Overcoming the Symptoms of Disease. (Bewältigung krankheitsbedingter Belastungen.) International Symposium on "Supporting Health in Chronic Diseases". („Gesundheitsförderung bei Chronischen Erkrankungen“) BZgA, Bad Honnef, 22d June 1987. - ⁴Sternbach, R. A.: Can I Learn to Live with Pain, Although It Hurts? (Kann ich lernen, mit Schmerz zu leben, obwohl es weh tut?) Revised Version in German by W. Keeser/M. Zimmermann. Berlin, Heidelberg 1988. - ⁵Melzack, R./Wall, P. D.: Pain Mechanisms: A New Theory. Science 150 (1965) pp. 971 to 979. - ⁶Von Uexküll, T./Wesiack, W.: Theory of Human Medicine. (Theorie der Humanmedizin.) Munich 1988 - ⁷Toellner, R.: The Re-evaluation of Pain in the 17th Century: Its Causes and Results. (Die Umbewertung des Schmerzes im 17. Jahrhundert in ihren Voraussetzungen und Folgen.) Medizinisch Historisches Journal 6/1971. - ⁸Larbig, W.: Pain. (Schmerz.) Stuttgart 1982. - ⁹Sanders, S. H.: Behavioural Assessment and Treatment of Clinical Pain: Appraisal of Current Status. In: N. Hersen/R. M. Eisler/P. M. Miller: Progress in Behaviour Modification. New York 1979. - ¹⁰Larbig, W.: Ref. 8. - ¹¹Schumann, H. W.: Buddhism, Founders, Schools, Systems. (Buddhismus - Stifter, Schulen, Systeme.) Olten 1986. - ¹²Ibid. - ¹³Zimmermann, M./Handwerker, H.O.: Pain - Concepts for Medical Action. (Schmerz - Konzepte ärztlichen Handelns.) Berlin, Heidelberg 1984. - ¹⁴Larbig, W.:

- Ref. 8. - ¹⁵Gerok, W.: Science and Experience Foundations of Medicine. (Wissenschaft und Erfahrung als Grundlagen der Medizin.) Therapiewoche 37 (1987), pp. 4142 to 4150. - ¹⁶Lazarus, R. S.: Ref. 17 Lazarus, R. S./Folkman, S.: Transaction Theory and Research in Emotions and Coping. In: L. L. G. Vossel: Personality in Biographical Stress and Coping Research. Europ. Journal of Personal 1987. - ¹⁸Lobo, R.: Ayurveda - Better Living in Rhythm of Time. (Ayurveda - Besser leben im Rhythmus der Zeit.) Zürich 1987. - ¹⁹Sternbach, A.: Ref. 4. - ²⁰Jacobsen, E.: Progressive Relaxation. Chicago 1938. - ²¹Keeser, W.: Ref. 1. - ²²Iyengar, S.: Light on Pranayama. (Licht auf Pranayama.) Bern, Munich, Vienna 1984. - ²³Lobo, R.: Yoga Elementary Course. (Yoga - Elementarkurs.) Vol. 1 to 6. Munich 1987. - ²⁴Ramm-Bonwitt, I.: Yoga Nidra - The Yogis' Sleep. (Yoga Nidra - Der Schlaf der Yogis.) Freiburg 1984. - ²⁵Grol, R. P. T. M.: The Prevention of Somatic Fixation. (Die Prävention somatischer Fixierung.) Berlin, Heidelberg 1985. - ²⁶Yabach, R. A.: Ref. 4. - ²⁷Tiedt, M.: Study of the Effect of Visualization of Cancer in Patients with Mammillary Carcinoma. (Untersuchungen zur Auswirkung der Visualisation des Krebses an Mammakarzinom-Patientinnen.) Thesis for a Degree in Psychology from Johann Wolfgang Goethe University Frankfurt 1986. - ²⁸Birbaumer, N.: Pain as a Psychological Problem. (Schmerz als psychopathologisches Problem.) In: M. Bergener/C. E. Helmmann: The Pain Syndrome - An Interdisciplinary Task. (Das Schmerzsyndrom - eine interdisziplinäre Aufgabe.) Edition Medizin. Weinheim 1987. - ²⁹Schmidt, R. F./Thews, G.: Human Physiology (Physiologie des Menschen.) Berlin, Heidelberg 1980. - ³⁰Wiemers, R./Wittke, K./Lemmer, B.: Changes in the Duration of the Local Anaesthetic Activity of Cartacaine plus Adrenaline in Patients in Dental Practice. (Diurnale Änderungen der Dauer der lokalanästhetischen Wirkung von Cartacain plus Adrenalin bei Kariespatienten in der zahnärztlichen Praxis.) Symposium on Chronobiology and Chronopharmacology, Frankfurt 23d October 1987. - ³¹Demisch, L./Rüther, E./Lund, R. et al.: The Natural Melatonin Profile in Patients with Chronic Insomnia and in Healthy Volunteers. (Natürliche Melatoninprofile bei Patienten mit chronischen Schlafstörungen und gesunden Probanden.) Symposium on Chronobiology and Chronopharmacology, Frankfurt 23d October 1987.

Dangerous Security

The Behavioural Biology of Risk

Felix von Cube, Heidelberg

Although man is always striving for security – at work, in marriage and family, for his old age and in religion – he also always takes astonishing risks. He climbs extremely difficult rock faces, he surfs in wind and rain, he risks his life in hang-gliding, he overtakes dangerously, he goes on adventure holidays or risks an extramarital affair or a heart attack. It is puzzling behaviour – instead of being glad to have more security he immediately puts it at risk.

More and more young, and not so young, people ride motorbikes, although, seen objectively, this is 40 times more dangerous than driving a car. Money is by no means decisive here. Firstly, motorbikes are often just as expensive as cars and secondly, there are not a few freaks who allow themselves a motorbike in addition, as a treat. In general it can be established that many people not only seek out risks but are prepared to pay for them dearly.

Something else is remarkable. Those with a safe car drive faster; those with a car with ABS brakes drive more dangerously. The insurance companies have long since withdrawn the benefit for ABS brakes – safety seduces to risk. Those who take a narrow curve with "40" take a broad one with "100". Psychologists speak of the "law of the conservation of misery"; traffic planners have apparently

not heard of it. The greater the safety the greater the risk! The man who believes in a guardian angel drives like the devil.

Professor Felix von Cube, born in 1927 in Stuttgart. Initially mathematics and science teacher; 1963 Professor for General Education at the Teachers' Training College in Berlin; 1970 Professor for School Education in Bonn. Since

1974 Professor for Education at the University of Heidelberg and Director of the Department of Education. Von Cube is recognized as the Pioneer of cybernetic pedagogy. In recent years he has expanded his field of work by the application of the findings of behavioural biology to education and management. Author of numerous scientific books among others: with D. Alshuth: Challenging Instead of Spoiling – The Findings of Behavioural Biology in Education and Management (Fordern statt Verwöhnen – Die Erkenntnisse der Verhaltensbiologie in Erziehung und Führung), Munich 1986, 4th Edition 1989; Master Those Nearest to You as You Do Yourself (Besiege Deinen Nächsten wie Dich Selbst), Munich 1988, 2d Edition 1989; Dangerous Security (Gefährliche Sicherheit), Munich 1990.



Prof. Dr. Felix von Cube, Erziehungswissenschaftliches Seminar, Universität Heidelberg, Akademiestrasse 3, 6900 Heidelberg/Germany

A nasty suspicion now arises. Is this behaviour also true for the way we treat the environment, for nuclear technology, genetic engineering and for other global and total risks? Do politicians, scientists and technicians feel so secure that they no longer notice the deadly risk? During a podium discussion with a Catholic colleague I recently experienced the following. I described the dangers of environmental destruction and attempted to indicate some consequences. My colleague then answered that it was not so bad. We were all in the hands of God and he would keep us out of danger.

He had said it clearly. A belief which gives total security also leads to total risk. But the total risk is then no longer private! We are all sitting in the same boat, in spaceship earth, and I would not like to be dragged to death by those who do not see the danger because they think they are in safety.

But how does this behaviour arise? Why does man seek both safety and security and risk and adventure?

Curiosity and Risk: Increase in Security!

At first it seems paradoxical, but it becomes clearer if we look at it more closely. Man seeks out risk to increase his security! What is the sense in exploring new countries? It is in getting to know those countries, in familiarity with the unknown, in increase in security! Equally, when we become acquainted with a new person we increase our security. The unknown becomes known, calculable, familiar. Why do we solve problems? We solve them so that they are no longer problems. We substitute known for unknown, security for insecurity. The new is only the stimulus for curiosity — the purpose of cu-

riosity is security. The purpose is to come familiar with the new and thus increase security.

It is then only sensible to investigate new things that appear in our environment. It is even more effective actively seek out what is new, to go beyond limits of our territory and to search for new problems. Certainly — the new unknown is connected with risk and insecurity. But the effort is worth it. If the environment that has been investigated extended, if more problems are solved and more knowledge acquired, then correspondingly more that is novel has become familiar and the level of security achieved is increased. We can move with confidence in a known environment, we know what we have to expect. We then direct our attention to what is not

We are now at the solution to our problem. Curiosity is an instinct! The stimulus for this is the new, unknown or uncertain. If the stimulus is absent we search out. We are greedy for what is new; exert ourselves to find it. When we have once found it we make ourselves familiar with it. It is incorporated into our security system and we convert insecurity into security! This is the sole and single purpose of curiosity.

The exertion combined with the search for the new and with the conversion of security into security is rewarded with pleasure. Everyone knows the pleasure that arises from the solution of a problem. This ranges from the "aha" experience to a dance of joy. Everyone knows the pleasure connected with surviving danger; you've managed it; it's like being born again.

Now we understand risk taking behaviour better: the new, unknown and possibly dangerous is only sought out on basis of security. If there is still insecuri-

it must first be removed. No one risks something when he is insecure, as insecurity means fear. A fearsome person must first bring his situation "in order"; he concentrates on re-establishing security.

However, if we have attained security and have been enjoying it, perhaps for an extended period, then we experience a "drive" to insecurity, to risk. We are hungry for risk and "eat" it up immediately. Once again Goethe saw it correctly: "I tumble from lust to pleasure and in pleasure I pine for lust". This is not only the case for the sexual drive but equally so for the curiosity drive, or better the "security drive".

Why do people with ABS brakes drive more quickly? Because they are looking for new insecurity on the basis of the security they have. Driving slowly is "unstimulating". The stimulus of insecurity is missing; it is boring. Driving quickly or better, risky driving, is stimulating. You experience the security which is being acquired in an intensive fashion. However, if you drive too riskily the insecurity becomes too great; you cannot remove it, it persists and you become fearful. Why is climbing so pleasurable? Because with every step you convert insecurity into security.

The "Flow Experience"

"In a world which, according to the general opinion, is ruled by the lust for money, power, respect and pleasure, it comes as a surprise to find people who ignore all these goals for unclear reasons: people who risk their lives in rock climbing, who devote their lives to art or their energy to playing chess. We hope to learn things which could improve the quality of our daily life by examining the character

of this joyful activity, for which material reward seems to be unimportant".

I would like to express my approval of these words of M. Csikszentmihalyi – with one exception. The reasons are not at all "unclear" – they are a result of the security drive of man. I will demonstrate this in a moment, but would first like to describe the results of Csikszentmihalyi.

To find out why certain activities are carried out with intense pleasure, in spite of exertion and risk, Csikszentmihalyi questioned passionate mountaineers, chess players, basketball players and surgeons. First I will repeat some of the commentaries from mountaineers:

"One of the finest experiences in climbing consists of the possibility of finding out each individual position. Each of these possesses an infinite number of possibilities for equilibrium. It is really fantastic to work out the best of these, both in relation to the present and to the next position". "You try and try till you find a solution".

The mountaineers answered the question if they thought climbing dangerous i.a. as follows:

"Climbing is only dangerous if you climb dangerously". "Very rarely. Now and again I do something that is dangerous. However mostly I think of safety when I climb". "To some extent you decide the degree of danger for yourself". "Not really, most happens as the result of ignorance. The better you are as a climber the better you can judge the results at any moment".

Only a single informant mentioned the danger itself as the actual stimulus, although its presence was certainly recognized. Questioning chess players, sportsmen and dancers i.a. lead to similar results.

Csikszentmihalyi describes this "particular dynamic state", the holistic feeling

of being totally involved in an activity, as "flow". What is decisive, is that humans devote themselves to the flow experience for its own sake and not for connected external rewards. Csikszentmihalyi writes, "No one has ever heard of a painter who packed away his brush after the completion of a picture. In most cases he is hardly interested in the completed picture. And which scientist has felt himself so rewarded by a discovery that he has stopped his research? The attainment of a goal is important to prove your own achievement, but it is not in itself satisfying. What keeps us going is the experience of acting beyond fear and boredom – the flow experience".

The author describes the essentials of the flow experience as follows: It must be possible to master the task. Flow only occurs when the subject is capable of carrying out the assignment. Flow demands the concentration of attention on a restricted field. The aim of the flow experience it itself.

Csikszentmihalyi describes the flow experience in great detail, but he can offer no explanation for it. The reason for this is that he does not recognize the flow activity, as instinctual, as being directed by the security drive. In fact flow arises through the (pleasurable) dismantling of insecurity and the renewed perception of or search for security. It is exactly for this reason that flow moves between fear and boredom, between too much and too little insecurity. At one place in his book the author describes exactly this: "Uncertainty means that flow is possible, while absolute certainty is static, dead, does not flow... "The observation that climbing always offers something new is in keeping with this.

The fact that flow is connected to an instinctive drive explains not only the simi-

larity of these experiences in the most disparate areas such as climbing, games and work, but also the experience of flow in a larger context. The flow experience then appears to be a concentrated instinctive event, which is also found in exploration and problem solving, albeit in a less condensed form.

The Five Risk Factors

From the drive for security one can deduce what I would like to call the security-risk law: the greater the feeling of security, the greater the risk. Someone who feels more secure than others has to take a greater risk to find insecurity. We children jump down from a wall mostly do this at the limit of their feeling of security. Then older or particularly athletic children go further than smaller and less athletic. We therefore see that subjective risk generally does not increase. When a skilled mountaineer tackles a very difficult climb he feels greater (subjective) risk than a beginner does with an easy climb.

In fact then the subjective risk is greater, but the objective is. Someone climbing a difficult rock face is objectively more at risk than someone walking in mountains. Someone riding a motorcycle risks objectively more than a car driver. Something more becomes clear, namely that the objective risk has two components – the objective probability of failure and the deleterious effects of this. It makes a great difference if you fall into the depths while mountaineering or your bottom while doing the "double axle".

Normally the security-risk law accompanies us safely through life. The small child only explores when it feels safe with the mother. The adult only takes risks

when he feels "up to it". However there are also dangers in this law, namely when we feel too safe — when our feeling of security is greater than the circumstances should allow.

Everyone knows cases in which one risks too much. Can we enumerate them? I think so. Five risk factors are decisive:

■ First factor:

Irrational Avoidance of Fear.

Fear is related to insecurity, so in the nature of things fear does not cause risk. This however can happen when the fear is removed by imaginary security, if you believe in higher powers which repel evil and which watch over and protect you. There are said to be politicians even today who base their decisions on horoscopes or other "predictions".

■ Second factor: *Overconfidence.*

Most people tend to overestimate themselves and to feel themselves larger, stronger or more intelligent than they are. In this way they destroy the equilibrium between security and risk. The overconfident person acts frivolously; he underestimates the dangers — and is killed by them. The old saying was right: pride comes before a fall.

■ Third factor: *Ignorance.*

You have no reason to feel insecure if you know nothing of an objective difficulty or if you underestimate the danger. Those who do not recognize the dangers of mountaineering or sailing unworriedly take a greater objective (not subjective) risk. Ignorance of the real difficulties and dangers is often based on irresponsibility. There is also the case that someone does not want to know anything of the difficulties or dangers. Most dangerous of all is and remains stupidity. Those who compare a reactor accident with its total and global results with a car accident are

catastrophically wrong. Such mistakes can cost millions of lives.

■ Fourth factor: *Boredom.*

It is well enough known that boredom causes people to look for quarrels, to race with the car or even to commit theft. But why is this so? The security drive explains it: boredom is the lack of insecurity! Security is complete; everything is known, stored, accustomed; you know the surroundings, the people, the daily life. So you are driven to the new, unknown, insecure. What do we do now? Where is something happening? The urge becomes irresistible. Finally you lust for everything that is new and any risk is acceptable. The drive demands satisfaction.

■ Fifth factor: *Pleasure.*

It is not only the pleasure in curiosity which leads to risk; pleasure of any sort is a risk factor. When sexual pleasure beckons many people are ready to risk disease or even death. Pleasure in aggression too can seduce to increased risk, for example when overtaking on the motorway or in general when beating rivals. From an evolutionary point of view moderate risk for sexual or aggressive pleasure is certainly reasonable. He who dares nothing, wins nothing — certainly, but please in moderation. He who strives for pleasure and avoids its natural inhibitor, fear, takes an uncontrolled risk. This highest level of risk is the basis of our risk taking society.

Risk Behaviour in Everyday Life

If we recognize our security drive and the law of risk we can understand our daily risk behaviour better and also the mistakes which we make every day. For example, let us look at the world of work. A nervous worker does not explore but is

continually occupied with restricting or removing insecurity. A worker can only be energetic, creative and innovative if he is in a secure environment, with a secure job and is not continually harassed by his boss or by excessive demands. Good, some will say, but how then does it happen that workers with high security, such as civil servants, are by no means always risk takers, or creative or innovative? The answer is simple: They often have no opportunity for this in their work. Security at work means searching for something new, so stimuli for curiosity must be offered all the time. If no new stimuli, no new tasks are offered to the secure worker, then he will look for risk in his spare time and will go on adventurous journeys or look for some other sort of adventure.

The results of behavioural biology also divulge new aspects in other areas: Is the law of risk also valid for marriage and partnership? Is too much security in partnership boring? Does boredom lead to extramarital affairs? Konrad Lorenz once said that modern man misses adventures. Does modern man feel too secure? Is our prosperous society becoming a boredom society? Is our society "unstimulated"?

For however important the consequences of the law of risk in everyday life may be — the global and total risks of our time are even more important. How could it come to this and how do we react?

Total Security — Total Risk

Because of his ability to reflect man is the only being who is conscious of the perpetual insecurity of life. A misfortune can happen at any time; a disease can develop or death can occur — either one's own or that of a loved one. Man knows that there is a future, but he does not know what it

will bring. This situation means total security; however, according to the security-risk law, total insecurity demands the feeling of total security — belief. The origin of the religions can then be explained on the basis of the security drive on hand and on the reflective ability of man on the other. Totally insecure man requires total security.

However the feeling of total security and safety does not only balance the potential insecurity of living and dying; security achieved leads to a new life which, under some circumstances, can be total. He who knows that he will survive death, perhaps in a high position, is prepared to risk death. In fact death signifies no risk at all for him, as he is convinced of his continued life.

Now it is certainly comprehensible that man, in view of the total uncertainty of the whence and whither and wherefore, seeks for "appropriate" security and finds it in belief. And tolerance and respect for other people demand that we accept and respect this fulfilment of the security drive. However we are now in a totally new situation. We are faced not only with the natural or, if you like, God-given insecurity of our own restricted and endangered life. We are faced with self-made mortal risks which some of our fellow men have made for us. How do people react to the total risks our present civilization? Either with belief or without belief.

The worldwide return to belief, either in the church or more privately, is due to the universal threat to life. This has always been the case. In times of necessity or danger or threat by wars, epidemics or cultural catastrophes people seek the corresponding security in belief.

The numerous adherents of the New Age Movement are also among those who

react with belief to the total risks of our time. The young people of today recognize and experience not only the natural insecurity of man, his exposure to an uncertain fate and his inevitable helplessness; they also experience the mortal and man-made threat to our lives. Many react to this with belief. If Christianity does not provide the longed for security they turn to other forms of belief or metaphysical systems of security. The present popularity of esotericism, occultism and sects is not accidental.

The reaction of "overcoming" the risks of our time with belief is understandable. However it can only be tolerated when no political consequences are drawn from it. Thus, after the Tschernobyl accident and the subsequent call for switching off the atomic power stations, a well known politician declared that the risk was certainly tolerable for those who believed in life after death.

This "argument" is not only wrong, it is also irresponsible and misanthropic. Personal belief cannot be employed for overcoming risk, for exactly the reason that all man are mortally threatened. This "argument" disregards the attitudes of all those who believe less or not at all. Even worse than this, it disregards the right of these people to life, which is all that they have.

However, not only can religious belief lead to total risk; this is equally true for the belief in the total reliability of science and technology. The technicians maintain that an atomic catastrophe could not happen in Germany; the genetic engineers maintain that they are fully in control of the results of genetic engineering. Many people too accept the total risk because of the enormous pleasure which prosperity offers. The risk is greatest when pleasure "drives" and no fear brakes.

However much we are silent about, ignore or accept the total risks — those who have recognized their full significance feel themselves, analogously to the passenger on a racing motorbike of which the driver believes in a guardian angel, like passengers on spaceship earth, which is steered by people who imagine themselves in safety. The "secure" endanger the "insecure"!

Safety in Nature, Risk in Culture

We now see the cause of the risk society. We have made serious errors in dealing with the security drive; we have sought security in belief, in science and in technology instead of in our natural environment and in our own nature. We have perverted the evolutionary process of winning security, that is the exploration of the surroundings. We have achieved spiritual security but annihilated the environment; we have idolized culture but destroyed nature.

The consequences are clear. We must deal differently with the security drive; we need security in nature to survive; we need risk in our culture to satisfy the security drive.

Security demands insecurity and the security drive can be satisfied in no other way. Just like the satisfaction of other drives the satisfaction of the security drive is an evolutionary necessity and thus a dictate of humanity. It would be absurd to refuse mankind something which evolution has granted to the animal.

Now one thing is clear. Insecurity may only be tolerated or even produced where the life and health of others are not endangered. In other words the risk may not be related to the natural environment, but "only" to the spiritual environment of

culture. Karl Popper said appositely that it was better to let theories die than people. That is exactly it; no one has the right on the basis of an established theory, i.e. a dogma, to put the lives of others at risk.

Is it not a fascinating perspective to see culture as an infinite possibility to create ever new uncertainty and to remove this pleasurable?

It is not instincts which endanger man, but if he deals with them unreasonably. However it is really feasible to deal with our drives in a reasonable or cultivated

fashion — with sexuality without population, with aggression without violence, with curiosity without endangering life. This is admittedly only possible if one consistently regards oneself as an instinctive being with reflective abilities as a “castaway” of evolution.

English Translation by R. A. Y...
Most pa
in the co
world h
tions ar
Impact
crises w
lead to
we thin

Literature

v. Cube, F.: Dangerous Security — The Behavioural Biology of Risk. (Gefährliche Sicherheit — Die Verhaltensbiologie des Risikos.) Munich 1990. — Czentmihalyi, M.: The Flow Experience. (Das Fließende Erlebnis.) Stuttgart 1987.

Natura
on earth
is either
German
Christia
as an i
Gilgarn
case th
of the p
and p
mordia

The F...
The fi
theory
Theor
Botani
that se
recogn
vertica
explai
world

Ecological Catastrophes During the Earth's History

What is the evidence?

Heinrich Karl Erben, Bonn

Most paleobiologists are of the opinion that in the course of the earth's history the living world has suffered from several mass extinctions and catastrophic crises. The so-called Impact Hypothesis proposes that these crises were caused by cosmic events which lead to the destruction of life. What should we think of this? What has been established?

Natural catastrophes which destroy all life on earth are one of the oldest myths. This is either at the end of the world, as in the Germanic twilight of the gods, or in the Christian myth of the last days, or is seen as an intermediate event, as in the epic of Gilgamesh or in the biblical deluge. In any case the origin of these prescientific tales of the primaeval and ancient world of saga and phantasy should be seen in a primordial and uncritical imagination.

The Fathers of Catastrophism

The first scientifically based catastrophe theory could be seen as the Cataclysm Theory of George de Cuvier of the Paris Botanical Garden (1812). It had struck him that several really abrupt changes could be recognized in the fossil fauna within the vertical sequence of the layers of rocks. To explain these changes de Cuvier assumed world-wide natural catastrophes which

lead to the sudden elimination of the existing fauna, which was then replaced by the rapid immigration of animals of other types. De Cuvier thought that he had de-

Professor Heinrich
Karl Erben, born in
1921 in Prag. Studied
earth sciences in Berlin
and Tübingen. Doc-
torate in 1949 and uni-
versity lecturer in 1951
in Tübingen. Research
and teaching at the
universities of Tübin-
gen, Würzburg, Mexico



City, Kabul, Columbia/S. C. and Bonn. 1963
to 1986 full Professor and Director of Depart-
ment of Paleontology in the University of
Bonn. Main areas of research: paleobiological
evolutionary research, stratigraphy, bio-
mineralization. Positions in national and inter-
national scientific committees, including 1980
to 1988 member (later president) of the Ger-
man UNESCO Commission. Published books
among others: *The Development of Life (Die
Entwicklung der Lebewesen)*, Munich 1975;
Life Means Death (Leben heißt Sterben), Ham-
burg 1981; *Is There Intelligent Life in the Uni-
verse? (Intelligenzen im Kosmos?)*, Munich
1984; *Evolution, a Review Seven Decades after
E. Haeckel (Evolution, eine Übersicht sieben
Jahrzehnte nach E. Haeckel)*, Stuttgart 1990.

Prof. Dr. Heinrich Karl Erben, Institut für
Paläontologie, Universität Bonn, Nussallee 8,
5300 Bonn 1/Germany

monstrated three or four of these cataclysms in the history of the earth. However his epigone Alcide d'Orbigny reckoned with not less than twenty nine and the Heidelberg geologist Heinrich Georg Bronn with at least twenty five to thirty. The Cataclysm Theory did not last for long. Twenty years later Charles Lyell's Principle of Uniformitarianism² became established, according to which all occurrences and processes in geological time should be assessed by earth scientists on the basis of present day analogies. This meant the end of catastrophe theory, as we know that present day catastrophes are regional at the most and never world-wide. Nevertheless one phenomenon remained problematical and has not been totally explained even today: the mass extinctions at times of the so-called "faunal breaks". It really does seem that several times in the course of the earth's history very large parts of the fauna have abruptly vanished throughout the world, so that the conception of global natural catastrophes remained in the earth sciences, at least in this connection.

The Neocatastrophism of the Grandsons

Earlier explanations of mass extinctions of prehistoric animals were always based on ecological factors, which were solely terrestrial. This changed with the start of the era of space travel and of nuclear weapons, which provided fertile ground for a neocatastrophism based on extraterrestrial events. This was the period of the first attempt to explain geological mass extinctions with cosmic causes. Initial theories, assuming a supernova near the earth, were soon superceded by the so-called Impact Hypothesis, which has earned international attention.

The Impact Hypothesis⁴ assumed that

at the times of the so-called faunal breaks the earth was hit by gigantic heavenly bodies ("bolides", asteroids). Thus there are indications that the heavenly body postulated for the transition from the cretaceous to the tertiary may have had a diameter more than 10 kilometers. It has been estimated that the crater from its impact may have been 190 kilometers wide and 38 kilometers deep. A scenario for the following events and their ecological results would be as follows:

- Mechanical destruction from the resulting shock wave, an extreme heat wave which spread throughout the world and the impact was in the oceans, a series of gigantic seaquakes.
- The formation of a gigantic dust cloud of pulverized stone, from particles hurled out of the crater; the rapid distribution of this cloud over most of the earth.
- Blocking off the sun's radiation by the dust cloud, causing general darkness for a duration of between three and six months and three years.
- Resulting interruption of photosynthesis in the plankton in the sea and in vegetation on the land, with all the negative results for animal food chains.
- Precipitation as acid rain.
- Poisoning of surface water with cyanide.
- Abrupt and dramatic changes in climate, either a dramatic drop in temperature (because of the blockage of solar radiation) or a rise in temperature (greenhouse effect; because loss of radiation from the earth's surface into space is reduced).
- Mass extinctions of large parts of the fauna in all conceivable environments on a global scale.

The duration of this global natural catastrophe was estimated as from one

ten years, and was thus seen as an extremely short-term event.

Excitement about the New Paradigm

The Impact Hypothesis is based on one main argument and a series of additional indications from the interpretation of empirical findings.⁵ These are all based on the situation at the so-called cretaceous/tertiary boundary ("C/T"), in other words on the sedimentary rocks deposited at the change from cretaceous to tertiary time. This was at the same time as the mass extinction said to have been suffered by the ammonites, the dinosaurs and many other animals. The Impact Hypothesis was then generalized to include faunal breaks at other times.

The main argument of the Impact Hypothesis is based on the finding of a striking geochemical anomaly in many different regions of the earth in the thin intermediate layer between cretaceous and tertiary deposits. The striking enrichment with iridium and osmium was characteristic. As on the one hand there was no known process on earth for the enrichment of these two elements, and on the other hand they were known to occur very frequently in certain meteorites, this anomaly was seen as a proof of the cosmic origin of the material deposited. The following observations in this intermediate layer were seen as additional indications:

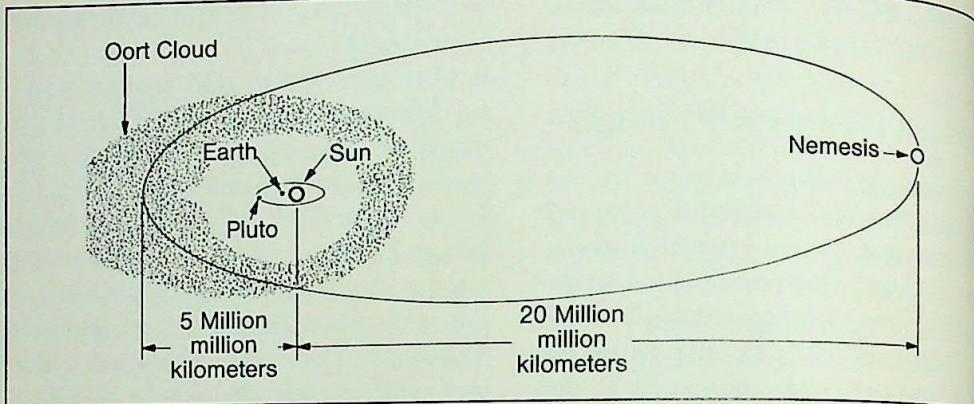
- The occurrence of two aminoacids⁶ which are rare in the biosphere but which are well known in stony meteorites.
- Microspheres of 0.6 to 1.2 mm diameter. These were seen as so-called microtectites, i.e. as material which had been melted and ejected out of the crater and which then solidified in the air.
- Accumulation of tiny fossil flakes of soot, which was explained as being due to

widespread fires, evoked by the impact of the asteroid.

- Grains of quartz with crossed lamellae deformation, which are an unambiguous shock structure after impact of a meteorite. The total argumentation seemed to be really plausible and convincing, which lead to its almost enthusiastic acceptance, not only in the press, radio and television, but also by experts. Critics, however, mostly paleobiologists, who advised caution received little attention.

Additional ad hoc Hypotheses

Two American paleontologists developed an extension of the Impact Hypothesis, which one might call the Hypothesis of the Periodicity of Mass Extinctions.⁷ On the basis of the statistical frequency of the extinction of marine animals in the various epochs of the mesozoic and neozoic eras of the earth they convinced themselves that the phenomenon of mass extinction of fauna had been repeated every \pm 26 million years. Following this some astronomers created the so-called Hypothesis of the Astronomical Clock.⁸ They assumed that the sun is accompanied by another star which is still unknown and which they gave the meaningful name of "nemesis". They inferred that this hypothetical messenger of death has an extremely eccentric orbit. At regular time intervals it passes through the equally hypothetical Oort cloud and causes a shower of meteorites of all sizes up to asteroids to rain onto the earth and the other planets. This is said to happen every \pm 28 million years, which is more or less in agreement with the alleged mass extinctions. Now it must be said that the statistical basis of the periodicity of mass extinctions has often been doubted. The latter hypothesis therefore must be rated as controversial. However hardly



Schematic representation of the "Hypothesis of the Astronomic Clock" (see text).

any one takes the Hypothesis of the Astronomical Clock seriously any more, as this has also been contradicted by astronomical evidence.

Disillusionment and Scepticism

As already mentioned, the Impact Hypothesis initially met with almost euphoric agreement from many experts and is still supported by many geologists. However in recent years more and more voices have expressed doubt and scepticism. Firstly there is the insistent question of the localization of the crater of impact which must have arisen at the time of the C/T boundary. The initial and evasive answers were that it is presumably to be found somewhere under the present oceans or that it was later swallowed in one of the subduction zones and thus annihilated.⁹ After this there was talk of the Manson Crater in Iowa. While it seems to be correct that the age of this really does correspond to the C/T boundary, its diameter of only 35 kilometer is much too small to be accommodated to the Impact Hypothesis. More decisive than this are findings in recent years which have very greatly impaired the strength of the main argument and of the additional indications for the Impact Hypothesis.¹⁰

— It is particularly problematical that the two aminoacids mentioned are not found in the actual boundary layer but one meter either above or below it. It is also disturbing that they were not decomposed by the heat from the postulated impact, as would have been expected.

— The microspheres could be of volcanic origin and thus quite definitely of terrestrial provenance.

— It is still uncontroversial that the accumulation of fossil soot particles comes from wide-spread fires. But the latter must not necessarily have been caused by the impact of a giant meteor, but could equally well have been caused by intensive volcanic activity.

— It has now been shown that the lamellar deformation can be observed in cases where the mechanical shock does not come from the impact of a meteorite, but from volcanic explosions. (Admittedly no crossovers have yet been found, but this cannot be excluded for finds in the future.)

It is particularly significant that the main argument has been weakened in contrast to the original view, accumulation of iridium and osmium has now been ascertained in the exclusively terrestrial sector, too. This includes the following cases: Fossil blue-green bacteria, volcanic

ash (in the blue ice in the Antarctic), sediments of the black shale type and volcanic gaseous emissions of the Kilauea volcano in Hawaii.

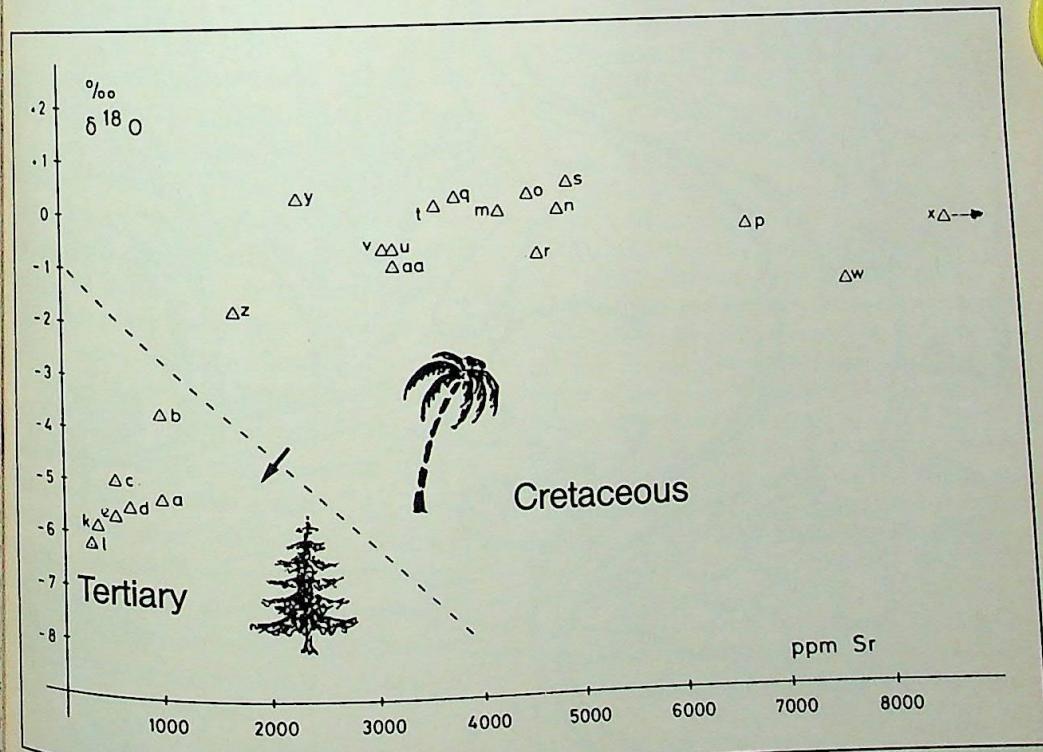
What is Documented and What is Conjectural?

While there seems not to be a wide acceptance of the additionally introduced mass extinctions, the striking cases which were originally identified are still worth discussing. With these I mean the faunal breaks at the end of the Ordovician (about 450 million years ago), at the time of the Upper Devonian (about 375 million years ago), at the Permo-Triassic boundary (about 250 million years ago) and at the C/T boundary (about 65 million years

ago). For the first three of these the Impact Hypothesis is generally no longer discussed; I have attempted to show how problematical it is in the case of the C/T boundary. It only remains to discuss the possibility that world-wide catastrophes of another type occurred.

Even in this connection the discussion of the faunal break at the C/T boundary is useful. The accumulation of extinctions of certain groups of animals and the demonstration of a connected ecologically based stress do clearly indicate a world-wide and temporary change in environmental conditions. But was it of a kind that would be described as catastrophic from the anthropocentric point of view? Several observations are speaking against this:

— A whole series of groups of animals,



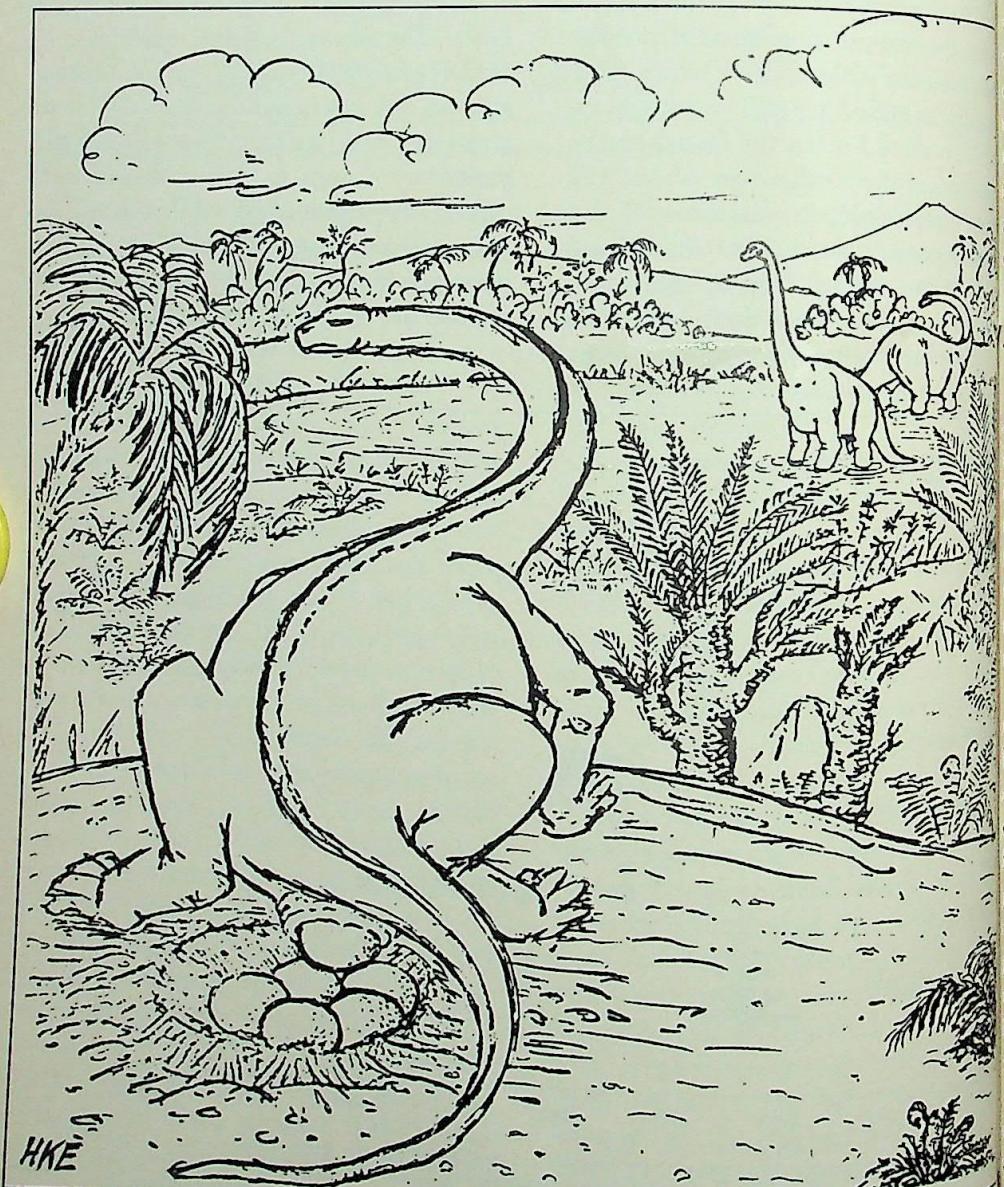
The world-wide ecological event at the cretaceous/tertiary boundary consisted essentially of a temporary change in climate. This has been substantiated in the western Mediterranean region by abrupt changes in the relationship between certain isotopes of oxygen and of carbon ($\delta^{18}\text{O}$) and of the strontium content (Sr) of the calcareous egg shells of dinosaurs. Pollen analyses at the same time show an analogous change from subtropical conditions (dominance of palms) to a temperate and humid climate (dominance of conifers), (from Erben/Hoefs/Wedepohl 1979 and Ashraf/Erben 1986).

such as the mammals and birds and some reptiles (surprisingly also the dinosaurs¹²) survived the putative stroke of fate.

— There were admittedly shifts in the spectrum of terrestrial plants, but very few extinctions.

— A closer stratigraphical study showed that the mass extinction of animals was

not at all a short-term and single event. The various groups did not die out at the same time but within an interval of about 2 to 3 million years. From the geological point of view this is indeed a strikingly short time, but from our personal point of view we would hardly connect it with a catastrophe. It seems much more to have been an ecological process.



Apart from other groups of animals some populations of dinosaurs survived the ecological changes at the boundary between cretaceous and tertiary times. Pathological phenomena in the calcareous shells of their eggs are dependent on hormones (vasotocin, oestrogen) and indicate ecological stress (Erben/Hoefs/Wedepohl 1979).

been an event of which the ecological results were caused by a paleogeographical constellation that occurred in a particular way and at random. An unusually large global *drop in sea level*, which has been known to geologists for a long time, lead to a considerable global increase in land area and to a drastic reduction in the shelf zones of the sea. At the same time *volcanic activity* rose in many areas, to a quite unusual extent.¹³ The interaction between these factors then caused a demonstrable, transitory and moderately intense *change in climate*, which then affected the global fauna through highly complex ecological chain reactions.

... and Our Ecological Crisis

Other paleogeographic constellations and factors may have played a decisive role in the case of the other faunal breaks. But in these cases too there seem to have been no events which were really disastrous from our point of view. More exactly, there seems to be no real justification for the neocatastrophic interpretation of the faunal breaks in earth history.

On the other hand, after 3.5 thousand million years of an admittedly unsteady but never really discontinuous development of life on our planet, the first really catastrophic mass extinction of global fauna and flora is taking place now, at the present time. The International Red List contains an enormous number of affected plant and animal species and unambiguously describes how many of these have become extinct or seriously endangered within recent decades.

The direct or at least indirect cause in all cases¹⁵ was and is extermination or unscrupulous displacement by the expansion resulting from the superexponential increase in population of a single species¹⁶,

namely our own, which ruthlessly claims all available living space. During this process resources are exhausted by excessive use and the natural environment is irreversibly ruined by pollution.

Anthropogenic destruction on a global scale which damages the sea and even the world climate has never occurred before in the history of the earth and is genuinely unique. Thus it can be predicted that this first real mass extinction will proceed in the future, unless it is stopped by one of two alternatives. Either the Biospecies Man returns to the "Principle of Responsibility" (Hans Jonas) or he brings about his own suicidal extinction.

English Translation by R. A. Yeates

¹ Cuvier, G. de: Discours sur les révolutions de la face du globe et sur les changements qu'elles ont produit dans le règne animal. Paris 1812. — ² Lyell, C.: Principles of Geology. London 1830. — ³ Schindewolf, O. H.: Neocatastrophism? (Neokatastrophismus?) Zeitschr. deutsch. geol. Ges. 114, 430 (1963); Russel, D. A./Tucker, W. H.: Supernovae and the extinction of dinosaurs. Nature 229, 553 (1971). — ⁴ McLaren, D.: Bolides and stratigraphy. Bull. geol. Soc. Amer. 34, 313 (1983); Alvarez, L. W./Alvarez, W./Asaro, F./Michel, H. V.: Extraterrestrial cause for the Cretaceous-Tertiary extinctions. Science 208, 1095 (1980); Hsü, K. J.: Terrestrial catastrophe caused by cometary impact at the end of Cretaceous. Nature 285, 201 (1980). — ⁵ For further literature cp.: Erben, H. K.: Faunal mass extinctions by eccocatastrophes? Journ. Paleont. Soc. Korea 1,1 (1985); ibid.: Chapter on "Neocatastrophism" ("Neokatastrophismus") in: Evolution, Seven Decades after Ernst Haeckel. (Evolution, sieben Jahrzehnte nach Ernst Haeckel.) Stuttgart 1990. — ⁶ Racemic isovaline and alpha-aminoisobutyric acid. — ⁷ Raup, D. M./Sepkoski, J. J.: Periodicity of extinctions in the geological past. Proc. Natl. Acad. Sci. USA 81, 801 (1984). — ⁸ Davis, M./Hut, P./Muller, R. A.: Extinction of species by periodic cometary showers. Nature 308, 715 (1984); Whitmire, D. P./Jackson, A. A.: Are periodic mass extinctions driven by a distant solar companion? Nature 308, 713 (1984). — ⁹ The expression "subduction zone" means the edges of continental plates which, during the "drifting" of these plates are pushed under

the edges of a neighbouring plate and thus "swallowed". —¹⁰ Cp. Ref. 5 and i. a.: *Archibald, J. D./Clemens, W. A.*: Late Cretaceous extinctions. Amer. Sci. 70, 377 (1982); *Hallam, A.*: Asteroids and extinctions, no cause for concern, New Sci. 104, 30 (1984); *van Valen, L. M.*: Catastrophes, expectations, and the evidence. Paleobiol. 10, 121 (1984); *Jaeger, H.*: The Faunal Change at the Mesozoic/Kenozoic Transition – a Sceptical Examination. (Die Faunenwende Meozoikum/Känozoikum – nüchtern betrachtet.) Zeitschr. geol. Wissensch. 14, 629 (1986). —¹¹ Ecological stress has been demonstrated for example by the extreme frequency of pathological phenomena in the calcareous shell of dinosaur eggs. This is clearly due to disturbances in hormonal metabolism: *Erben, H. K./Hoefs, J./Wedepohl, K. H.*: Paleobiological and isotopic studies of eggshells from a declining dinosaur species. Paleobiol. 5, 380 (1979). —¹² Dinosaur remains have been found in the Old Tertiary in the Provence, cp. *Erben, H. K./Ashraf, A. R./Krumseck, K./Thein, J.*: Some dinosaurs survived the Cretaceous "Final Event". Terra cognita 3, 211 (1983). Moreover they also occur in New Mexico (San Juan Basin), Peru (Laguna Umayo), Argentinia, India (Maharashtra, Gudjerat) and probably in eastern China. —¹³ The

volcanism of the C/T boundary mainly covered enormous areas of the Indian subcontinent and the region from NW Britain through Greenland to Baffin Island. —¹⁴ Measurements of oxygen and carbon isotope and of the strontium content of calcium carbonate show a change from a hot and dry tropical climate to a somewhat wetter and more moderate climate. (Ref. 11). This is supported by a change in the floral spectrum: *Ashraf, A. R./Erben, H. K.*: Palynological Studies on the C/T boundary in the Western Mediterranean. (Palynologische Untersuchungen an der Kreide/Tertiär-Grenze westmediterraner Regionen). Leontographica B 200, 111 (1986). —¹⁵ *Ziswiler*, Endangered and extinct animals. (Bedrohte und ausgestorbene Tiere.) Berlin 1965; *Simberloff, D.*: proximate causes of extinction. In: *Phanerozoic patterns and processes*. Dahlem Konf. Berlin 1985. —¹⁶ Cp. i. a.: *Erben, H. K.*: Population Dynamics in the Extinction of Species – our Dilemma. (Populationsdynamik und Artentod – unser Dilemma). In: *M. Lindauer/A. Schöpf (Eds.): The Earth Our Home. Over- and Underpopulation as Problems of Population Dynamics*. (Überbevölkerung und Unterbevölkerung als Probleme einer Populationsdynamik). 2. Würzburg Symposium, Stuttgart 1987.

SPECTRUM

SPECTRUM

SPECTRUM

Geology

The Catastrophe as a Normal Occurrence in the History of the Earth

About 65 million years ago, a catastrophe took place on the earth. The dinosaurs suddenly died out, and more than half of all the animals and plants living at that time along with them. This wasn't the only momentous turning point in the history of the earth's development. In recent years, researchers throughout the world and from widely differing disciplines ranging from palaeontology to astrophysics have discovered further episodes of mass extinction.

These findings have been combined in an international research project, "Global Biological Events in Earth History," of the International Palaeontological Society (IPG). The goal is to detect the causes and possible patterns of these "bio-events," as these cases of mass extinction are called by the scientists.

When the Americans David Raup and John Sepkowski, Jr. published an analysis of fossil material in 1984 and concluded that every 32 million years mass extinction of species occurred, they were met with widespread skepticism on the part of science. Today it is known that such events are probably less far apart, at about 26 million years. Moreover, as is becoming more and more apparent, these catastrophes, of

which five of great magnitude have thus far been proven to have occurred, seem not to have been exceptions, but rather the rule in the earth's history. The most recent and best known event was accompanied by the extinction of the dinosaurs at the turn of the geological



Was the death of the dinosaurs caused by a meteorite?

(Photo: Ullstein)

tute of the University of Göttingen, the head and initiator of the international research project, this thesis, which has meanwhile been proven for the most part, is one of the most significant research results. Particularly, scientists from the United States, for example the geologist Walter Alvarez and the nuclear chemist Frank Asaro have carefully compiled the evidence for the impact theory, which was long in doubt.

This caused many scientists to believe that extraterrestrial bodies were also responsible for other events which have influenced the earth's development. But this has not been corroborated to date. On the contrary: very earthly reasons could always be found to explain them, such as the Ice Age, warming of the climate, or changes in the oceans' currents. In most cases, however, a single spectacular cause does not suffice to explain mass extinction. As a rule, processes began beforehand which imperceptibly changed the ecosystem and suddenly peaked in a catastrophe. This is also true of the "Kellwasser Event," named for a little valley in the Harz Mountains. There geologists discovered the traces of a geological drama which later proved to be not just limited to the area. Walliser was one of the first to discover corresponding geological formations on his travels in various countries.

The Kellwasser Event began about 365 million years ago, with temperature fluctuations and first freezing when the continents and connecting waterways gradually shifted as a result of the drift of the litho-

spheric plates - which is still going on today. More and more, the chemical composition and the entire current system of the world's oceans were changed. Layers of cold water containing little oxygen rose to the top and replaced the warm layers rich in life-giving oxygen. Finally, the entire ocean reached the stage of biological collapse which meant the demise of the living environments and ecosystems of more than half the animals. Geochemical analyses of rock samples of the Kellwasser sediment, as performed by Dr. Eberhard Schindler of the University of Göttingen, confirm this. Layer for layer, the German geologist examined these extremely old rocks, thus revealing the events of that time. At the end of his work there was a list of the extinct species and the survivors. On the uppermost, dark borderline layer to the light, younger limestone, more than half of all the species of the time, predominantly micro-organisms, can no longer be found. This is true, for example, for the biothermal (clearly protruding) reefs which were mostly built by corals. With them a highly developed biotope disappeared. Almost identical evidence of this event can be found on nearly all continents.

The research results suggest that these "episodes of mass extinction were more common than has been hitherto believed," as Walliser puts it. Therefore it is wrong to interpret this periodically occurring mass extinction as a catastrophe. For one of the surprising results of the research was that an accelerated biological development

follows these events, during which completely new forms come into being and ones are now able to establish themselves in their own right. But the most adaptable were always the ones who survived. Sometimes good luck was needed, too. So evolution to intelligent life did not occur straight line; setbacks and chance played a significant role. Particularly highly specialized forms of life are repeatedly threatened in their existence by environmental changes. Thus, 65 million years ago, the mammals were among those who made it, whereas they had led only a marginal existence "under" the dim sun and didn't influence life on earth until their extinction. A further hypothesis of Göttingen geology professes a corollary to these findings: these phases are the rule rather than the exception in the history of life, "then a due portion of this history was spent recovering from such episodes." After the causes of this mass extinction, these recovery phases will now be studied in the planned five-year follow-up project (biotic recovery after mass-extinction events). Scientists also want to look at patterns and species with survival skills during these evolutionary phases. The new project should yield important insights for the world today. For the opinion of Professor Walliser and many other researchers we are now living in the middle of a mass-extinction phase, a bioevent. In this case, the causes needn't be looked for in extraterrestrial nor natural, but simply human-made.

Medicine

Grey Cataract: a Collapsible Lens

(d). An incision only 3 mm long is enough these days to remove the once-feared grey cataract for good. New artificial lenses on the one hand and the use of ultrasonic and laser technology on the other have made this quality advancement possible, thanks to which apprehension about the risk of infection after successful surgery has been further reduced. First attempts to relieve this ailment by eye surgery were already undertaken 4,000 years ago, by the way.

By now implanting an artificial lens has become the rule when the eyes take on a milky cloudiness and there is the danger of going blind. This procedure is followed in four of five cases, according to Professor Jörg Draeger and Dr. Rudolf Guthoff of the Ophthalmological Clinic of the University of Hamburg. Surgery to remove a grey cataract is a routine procedure today and is performed about 1.6 million times a year in the western world. But now a crucial new development has been achieved in this technology.

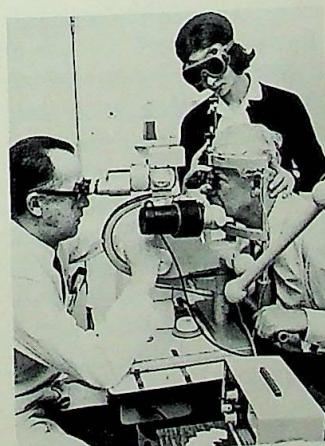
To prevent the patient from going blind, the milky, clouded ocular lens must be removed. In the process the sharpness of vision is of course reduced to five percent. This can be corrected with "cataract eyeglasses," but this narrows the field of vision, and the image on the retina is enlarged by nearly a third. In contrast, the artificial implanted lens approximates natural sight much better and is thus used whenever possible. It is implanted in the anterior chamber, now free of all cloudy elements. From the time this technique was developed until the present, plexiglass has been used for the lens, as no development of modern plastics chem-

istry has been able to replace it. The smaller the surgical intervention, the more sparing for the patient: for this reason, the hard core of the ocular lens is no longer removed in one piece, but is first disintegrated with high-energy ultrasound. The fragments are then removed by suction or rinsing. This enables the incision in the eye to be limited to a tiny three millimeters. Of course, perfecting the method requires an artificial lens which can be implanted through such a minimal opening. In this way infections, which affect every thousandth patient and can lead to blindness, could be further reduced. In solving this problem, Drae-

ger and Guthoff have gained experimental and clinical experience with lenses made of elastic silicone caoutchouc which are collapsible and don't re-open until after implantation. Thanks to the particular properties of the material, they "remember" their original form precisely on re-opening. Possibly, the scientists hope, this could solve another post-operative cataract problem. The better the anterior chamber is drawn taut by the lens, the less often a post-operative cataract is formed. This is indicated by clinical studies and animal experiments.

A post-operative cataract occurs when the anterior chamber, which was still clear during the operation, clouds up afterwards. After all, this phenomenon occurs with about 40 percent of the patients under 50 but becomes rarer with increasing age. Nowadays this further sight impairment can be removed very quickly: with the high energy of a laser, the anterior chamber is penetrated at the points which incidental light must transverse. With this procedure, which can even be performed on outpatients, vision is usually immediately restored.

A particular capability of the human eye has thus far not been imitated by the best-made artificial lens: healthy eyes automatically focus on the object they are looking at; but for implants the range of focus is determined once and for all - usually, and sensibly, beyond the close-up range. Experiments with several focal points ground into the lens for the patient to use as required are con-



With the high energy of the laser vision is usually immediately restored.
(Photo: Ullstein - dpa 85)

troversial in ophthalmology because of a disadvantage inherent to its design: the visual range is by necessity surrounded by unfocused areas, thus impairing image contrast.

A new development could solve this dilemma, even if its large-scale application still

seems far off in the future. In the anterior chamber cleansed of cloudy fluid, a substance is filled which refracts the light just as the removed lens did. In this way, natural vision can be preserved, including focusing adjustment at various distances.

New Technology for Electric Automobiles

The Rail Goes Along for the Ride

(saw). The high environmental stress caused by the exhaust of internal-combustion engines, particularly in densely populated areas, has long moved engineers throughout the world to look for more environmentally beneficial alternatives. Electric drive systems, as promising as they are, have thus far proved to have too many disadvantages. At the Hannover Trade Fair, a new technology for electrically powered vehicles was presented which until now has only been feasible with vehicles on rails.

Not only has the lack of lightweight, powerful batteries hampered the development of electric automobiles hitherto. The problem of the mechanical transmission of engine power to the wheels has not yet been solved to satisfaction, either, so that up to now one was content with simply replacing an internal-combustion engine with an electric motor, but leaving the transmission, clutch, and brake systems as they were. In this way, some important features of the electric motor were not taken advantage of.

The new contact-free electric drive, for which Professor Klaus Hofer of the Bielefeld Professional School (Fachhochschule) has a patent pending, utilizes a principle which is in use in magnetic-levitation trains such as the "Transrapid." In contrast to a cogwheel train, which "hand-over-hands" its way mechanically along its rail, the maglev train has no contact

with its rail. The power transmission is performed "by an invisible hand," i.e., by magnetic fields. Along the coach, spools are mounted inside, through which rotary current flows. When current flows through one spool, a magnetic field is produced there. By virtue of the particular arrangement of the spools, the magnetic fields produced along the coach floor of the maglev train move towards the back. The rail is made of copper, but its core is of iron; the magnetic field on the floor of the coach then magnetizes a segment of this rail and attracts it. With that, a "coupling" takes place between the rail and coach. When the magnetic field then shifts towards the back through the coach, the coach is thrust forward – the coach accelerates. This drive principle is called a linear motor because – in contrast to conventional motors – no revolution takes place. Professor Hofer got an idea

how this drive technology rail vehicles could be used electric automobiles, as well as the rail were mentally bent form a circle and the coach riding on it were held fast, he gues, the rail under the would "rev up." If we imagine the circular rail wheel, the result is a contact-free electromagnetic drive. So all that needs to be done is to mount little rings on the rims of car wheels. The little "coach" which carries the moving magnetic field inside it is fastened to the basis. This is all very difficult to accomplish technically, for instance because the air gap between the "coach" and the rail should only be 4 mm without there being any contact. But it is worth the trouble after mounting this drive mechanism, the vehicle is nearly complete: transmission, drive, even brakes as we know them are unnecessary. For the electric motor has the important advantage over the internal-combustion engine that the coach can not only be accelerated by input of electrical energy, but also by the reverse process, the braking of the vehicle by adding energy on the "dynamo principle" is also possible. The kinetic energy is thus no longer "wasted" in heating up the rail linings, but is used to charge the batteries. This would be a great improvement in energy efficiency. The "electrical brake" – any dynamo – is only effective as long as the wheel is turned; an anti-blocking system is thus standard equipment if it were.

The electric automobile pro-

ces no exhaust itself. Even when the emission of harmful substances involved in obtaining the energy for charging the batteries is included in the equation, the electric drive is in a better position than conventional petrol or diesel motors, thanks to its "brake bank." In addition, it operates nearly free of wear because the power of the linear motor is transmitted contact-free. The development

of new high-power batteries in the United States which use hydrogen hydrides for energy storage opens prospects of increasing the range of electric automobiles to 2,000 kilometers. Filling up at specially provided hydrogen filling pumps would then only last a few minutes. Perhaps such filling pumps and electric automobiles will soon be an everyday sight on our streets, at least in the cities.

but also on external factors. These include the quality and amount of food, growth factors excreted by the "reigning" queen, and seasonal influences. Thus, in bad times a colony will produce many workers who ensure that the colony survives. In good times, on the other hand, expansion and the founding of new colonies take the upper hand, and more young queens are hatched.

The research group headed by Professor Alfred Buschinger of the Darmstadt TH studied a species of ant in which for the first time a gene could be identified which is involved in determining whether an ant larva develops into a queen or a worker.

The scientists studied the slave-making ant *Harpagoxenus sublaevis*, which founds its colonies by forced conquest of the nest of other ant species. The workers of the attacked population are then used as slaves to take care of the conquering species' brood. In *Harpagoxenus* it was found that in most of the populations studied, the queens looked very much like the workers. They were therefore given the scientific term "intermorphous." Populations with intermorphous queens could have "normal" queens in their progeny and vice versa. However, this could not be influenced by any external factors. So the researchers looked for a hereditary, genetic cause for the two forms of queens. And indeed, they discovered a gene which occurs in the ants in two different states (alleles), which they called "E" and "e." Each fertilized ant egg receives one copy each of the gene from the father and mother. If at least

Zoology

A Gene Regulates the Ant Colony

(df). The life and behaviour of a species of slave-making ants endemic to Europe has been under study for years by scientists at the Darmstadt Polytechnic (TH). In their research they succeeded in discovering for the first time a gene which influences caste formation in the ant colony but also leads to the occurrence of two markedly different forms of queens.

Normally there are two different castes in an ant colony. The queen has the task of producing progeny; the army of workers help her and also keep the colony in order and take care of the brood. In most ant species, the queen is much larger than a worker. At first she has wings and mates with a male. The

sperm she receives she stores in a sperm pouch in her body and uses it for years to fertilize her eggs. After mating she discards her wings and founds a new colony. The workers never grow wings. They lay unfertilized eggs, from which only males can hatch. Because these have received no paternal genetic make-up, their body cells contain only half as many chromosomes as those of the workers or queens. As the males' only task is to mate with young queens, they are not regarded as a caste in their own right in the ant colony—they are merely involved in its foundation.

Whether young queens or workers hatch from the queen's eggs is not discernible by the looks of them. First of all, ant larvae hatch from them, which are taken care of by the workers. Their further development depends not only on hereditary,



Queen of the slave-making ant *Harpagoxenus sublaevis*.
(From: Naturwissenschaftliche Rundschau, 3/1992)

one of these two is present in the form "E," the egg can produce "at best" an intermorphous queen - this is in turn decided by food and other external factors. Normal queens always have two copies of the gene in the "e" state.

Professor Buschinger sees in the intermorphous queens by no means a new, third caste, as they perform precisely the same tasks in their colonies as "normal" queens in other colonies. In general, as regards this function, not the slightest differences could be found between the two forms of queens: in length of life, mating success, or the struggle to found new colonies, the ants with differing alleles of the gene were in no way inferior. It was thus not clear at first what the newly discovered gene was supposed to be good for.

But light was soon shed on this

question when ant larvae of differing genetic constitution were reared under otherwise equal conditions. It was found that in this case larvae with two copies of the allele "e" produced many more queens than the (EE) larvae, which produced workers at a much higher rate. The figures for (Ee) larvae were between these two and were in general particularly favourable. From these results, the scientists concluded that the best chances for survival and reproduction are with a colony with a "hybrid," intermorphous (Ee) queen. Half the egg cells of such a queen will contain the E gene and the other half the e gene. Hence, after fertilization with E sperm, the queen lays (EE) eggs and (Ee) eggs, thus endowing copies of both her genes on her progeny. The population will first of all - from the (EE) eggs - produce sufficient numbers of

workers, which is particularly important for a young colony faced with many dangers. Nonetheless, as soon as "standard of living" of the population has improved enough queens will hatch from the (Ee) eggs to ensure the production of the species - with it the two alleles E and e. The advantage for survival of the colonies with intermorphous (Ee) queens as compared to others thus ensures that both alleles of the gene are permanently preserved. The fact that intermorphous queens look so much like workers is in Professor Buschinger's view an accompanying phenomenon of comparative small significance. It is much more important that the newly discovered gene determines composition of the ant colony and thus its chances for survival.

Preview

The next issue of UNIVERSITAS
will presumably contain the following contributions:

Politics and Society

Peace – Justice –

The Preservation of the Environment

Carl Friedrich von Weizsäcker, Starnberg

Law

Human Rights vs. Reason of State:

**International Law On the History
of International Institutions**

Otto Kimminich, Regensburg

Politics

**The Foreign Citizen – Rules of the Game
for a Republic of Many Peoples**

Claus Leggewie, Gießen

Educational Science

Useless Education?

Rainer Dollase, Bielefeld

Economy

Money and Magic – The Economic

Background of Goethe's Faust

Hans Christoph Binswanger,
St. Gallen/Switzerland

Evolutionary Biology

The Narrow Ridge of Life

The Ecological Challenge of Evolution

Bernhard Verbeek, Dortmund

Medical Psychology

Spatial and Temporal Environment

The Chrono-Ecology

of Biological Rhythms

Till Roenneberg, Munich

Peace – Justice – The Preservation of the Environment

Carl Friedrich von Weizsäcker, Starnberg

In our history relations between the Enlightenment and religion have not been without tensions. The impassioned appeal of the Enlightenment in its political aspects was that it held out the prospect of realizing at last the ideals of freedom, equality, and fraternity which Christians had proclaimed for two thousand years, but which, had never been achieved, as long as they were in power. Followers of the Enlightenment point out that Christian practice is far from being complete. But can it be said that the French Revolution led to fraternity among free and equal men and women? Did it not lead to class rule of a new kind? Did it not lead to the rule of the propertied classes in bourgeois society and of functionaries in socialistic systems? The Enlightenment, as it has worked out in practice, is ridden with imperfections; and these imperfections constitute a mortal danger to mankind. What should we think today? And what must we do?

First of all, what line should our thinking take? Kant's famous essay on eternal peace, „Zum ewigen Frieden“, is perhaps the most beautiful text of the Enlightenment in its political aspects. Kant points out that in a legally ordered state, people live under conditions of civility; but in their external relations with one another, of that primitive state of nature in which everyone fights against everyone else. It is

Professor Carl Friedrich von Weizsäcker was born in Kiel in 1912. From 1929 to 1933 he studied physics at three German universities: Berlin, Göttingen, and Leipzig. The subsequent stages of his academic career have been as follows:

From 1937 to 1942 he was lecturer in theoretical physics at the University of Berlin; from 1942 to 1944 professor of the same subject at the University of Strasbourg; from 1946 to 1957 head of the Max-Planck-Institute for Physics in Göttingen, where he also had the title of „honorary professor“ of the University; from 1957 to 1969 professor of philosophy at the University of Hamburg. In 1970 he was appointed director of the Max-Planck-Institute in Starnberg for research bearing on living conditions in the world of science and technology; and in 1971 he received from the University of Munich the title of „honorary professor“ of philosophy. Professor Weizsäcker has received numerous honours, including the Peace Prize of the German Book Trade in 1963. Among his publications the following may be mentioned: „Diagnosen zur Aktualität“, 1979; „Deutlichkeit“, 1979; „Der Garten des Menschlichen“, 1978; and the article entitled „Das Schöne“, published in UNIVERSITAS, 1988.

Prof. Dr. Carl Friedrich von Weizsäcker,
Bahnhofplatz 4, 8130 Starnberg/Germany



the demand of reason to create conditions of civility. Kant distinguishes between legality as behaviour in accordance with law from morality as behaviour out of respect for the law. The law is here the dictate of reason. Behave so that the maxim of your behaviour could at all times become the principle of universally valid legislation. It can perhaps be said that this distinction between legality and morality represents the greatest progress in political ethics that has been made in the western world in modern times. Morality is something that I must require of myself and observe in dealings with my fellow men; but it is not for me to judge the morality of my fellow men. On the other hand, the legality of our behaviour is a matter which a secular judge is competent to deal with. War as an institution, that is to say, the organized killing of people having other interests than the group one belongs to cannot be a principle of legislation valid for all mankind. There must therefore be an end to war as an institution.

What must we do? My earliest childhood recollections go back to the year 1915. At this time we lived in Stuttgart and though only two or three years old, I knew that something called war was going on. Men were out there somewhere; it was said that they were at the front. A terrible thunder could be heard from afar. Next to the castle was a military hospital. One could see men with bandages around their heads, and men with only one leg moving on crutches. My mother wore a Red Cross Uniform. It was during the 1920s that I first became politically conscious; and this was occasioned by the conflict of the Great Powers together with unemployment and marching political formations on the streets of Berlin. In January, 1929, during

a boring history lesson at school, I had daydream in which the large snowflakes that were falling outside were falling rubble. Fourteen years later, in 1943, Berlin looked just as I had seen it in that dream.

Living with the Bomb

But by 1943 I already knew something about what the future was to bring. January, 1939 Hahn had published news of his discovery of atomic fission neutrons. Shortly thereafter, Joliot covered that secondary neutrons were released by this fission. It was now clear to any nuclear physicist that chain reaction in other words, atomic bombs and reactors would become possible. On the day when this became clear to me, I went to see my friend Georg Picht to discuss the consequences of this. We two young men came to the conclusion that, unless war as an institution was abolished, humanity would not survive. For if atomic bombs were possible, they would be made. And if these bombs were made, then they would be used. And if once used, they would never disappear. In the 1950s Leó Szilard discussed the problem in the following terms: "Our problem is not how to get rid of the atomic bomb, but how to live with it." In other words, even if atomic bombs should be destroyed, mankind would still retain the knowledge how these bombs are made. Living with the bomb does not mean politics as usual with the bomb added on. Living with the bomb means bringing about such radical changes in the political organization of mankind that there is no longer any occasion for the possession or use of atomic bombs, and similarly with biological, chemical, and high-tech weapons. What "living with the bomb" really means

that war as an institution must be abolished.

War Must Be Abolished

It is easy to maintain that it is impossible to abolish war; but if one takes this position, then honesty compels one to add that this means that in this technological age mankind has no future. Today the possibility of a Third World War does, indeed, exist, whether as a result of human error, technical breakdown, miscalculation or panic. But it is wrong to take the attitude that war as an institution is a necessary consequence of human nature. Changes in attitude and behaviour are possible and do take place.

Once again I should like to look back to Stuttgart. Uhland recounts how Count Eberhard went forth from the gates of Stuttgart to Wildbad, where his enemies attacked him. His son Ulrich was killed in the war against Reutlingen; and in Heimsheim the leaders of the knights of the Schlegler were attacked and captured. Would you have liked to live at that time? It is perhaps true that election campaigns today are not always on a higher moral level than a war between Stuttgart and Reutlingen, but they are closer to legality. As a child I learned that France was our hereditary enemy, though I am happy to say that I did not get this idea from my parents. Seventy years from now what will people say about our conceptions of people whom we consider to be our enemies?

My subject today can be formulated in the questions: What are the specific causes of our unsolved problems, and what concrete steps should we take? I shall consider these questions in terms of peace, justice and nature.

Peace

Of all the conflicts of the past few decades, the East-West conflict, that is to say, the conflict between America and the Soviet Union, was the most dangerous for mankind, and, at the same time, the most pointless and unnecessary. It is the present-day form of the age-old conflict for hegemony which has always happened in history in an area capable of technological, economic and intellectual unity. We recall Rome and Carthage in the area of the Mediterranean Sea; the royal conflicts in China during the age of Confucius; and, in modern European history, the conflicts between England and France in Western Europe, and those between Austria and Prussia in Germany. Today the area of conflict encompasses the entire planet. To be sure, the ideological conflict, concerning which I shall have a few words to say in discussing the problem of justice, does have real substance; but it does not provide a justification for war. In a conflict for hegemony, it provides each side with a pretext for having a clear conscience. The fact is that conflicts of hegemony can also be resolved by coexistence. What have England and France lost as a consequence of no longer waging war against each other?

In this conflict America is stronger: definitely superior in the economic sphere; more advanced in technology; and, internationally speaking, more convincing in its ideology, despite all weaknesses. Furthermore, America can achieve military superiority whenever it decides to do so. It was only in the race for armaments that the Soviet Union was able to keep up with America; and this was achieved by giving priority to armaments, in accordance with an old Russian tradition. For a very long time I expected with

deep concern that the 1980s would be the time of such a war since Russian armaments would then achieve their maximum potential, thereby inciting America to begin a new armament programme. We owe the present movement for détente to the victory of sound common sense among the Soviet leaders. We can only hope that the same common sense will be shown in the West.

Disarmament as the Road to Peace?

Disarmament is now one of the pressing questions under discussion. I must admit that until now I have never believed in disarmament as the road to peace; peace is the road to disarmament. I have never seen voluntary disarmament of weapons that are considered militarily important. Were the medium-range ballistic missiles really so important from a military viewpoint? But what we see today is the urgent economic interest of the Soviet Union in achieving reduced armament costs. I am convinced that this interest is genuine, because it is in harmony with a healthy self-interest. And entering into negotiations is at least a step in the direction of accepted coexistence, which, ultimately, would be peace, something more than the long period of armistice we have had hitherto.

For the present and until the time comes when a sufficient degree of mutual confidence will have been established, there is something that is even more important than disarmament, and that is the restructuring of armaments on the continent of Europe for purely defensive purposes. It is today technically possible to develop conventional weapons, which, though hardly useful for aggression, are extremely well suited for purposes of defence.

However, the most urgent problem in the wars of the southern hemisphere. Since 1945 there has been no military conflict that could have developed into a nuclear war; but there have been more than 130 non-nuclear wars. Most of them were not proxy wars of the northern powers but resulted from local and regional conflicts as always in history. The interests of the northern powers in these conflicts are primarily the financial interests involved in the export of armaments. I think that this export of armaments is simply foolish even when considered purely from the viewpoint of self-interest. In the long run Europe and North America will not remain as peaceful islands in a world at war. The urgent necessity to abolish war as an institution applies equally to these conflicts.

Justice

We have just glanced at the southern hemisphere of our planet. In the second of the two great conflicts of our time, the so-called North-South conflict, the South calls for justice, social justice, that is to say, justice for the poor. This conflict shows itself as an internal problem, a problem within the South itself that is to be seen in the tremendous contrast between poverty and wealth. A glance at the skyscrapers of São Paulo gives an indication of how much money has been earned and invested here; on the other hand, a visit to the hovels and shacks of the slums shows the dire poverty in which the majority live and die. However, notwithstanding this internal aspect, the problem is rightly conceived as one between North and South, inasmuch as the national economies, and especially those of the South, are today dependent on the world economy, and this is dominated by the North.

We have here, it seems to me, the most inescapable problem confronting mankind today, and, at the same time, the one that is most difficult to solve. It is a matter of urgent concern to all of us. What are its causes? How can it be alleviated? And what action is possible?

The answer to the question as to which cause a certain person considers to be decisive can in many cases be anticipated by bearing in mind this person's economic and political situation. Prosperous people in the North assume that the chief cause of poverty is population growth; in the South champions of the poor maintain that the problem is to be sought in the capitalist system of the world economy; members of the ruling classes point to the cultural backwardness or to the race of the people living in such poverty. In what proportion are these various factors involved?

Population growth is made possible by medicine, increased production, and the transportation of goods, in short, by the benefits of civilization thanks to which it is no longer true that months which cannot be fed die at a tender age. But humankind cannot acquire this control of its living conditions and at the same time renounce control of the number of children. And it doesn't. The experience of the industrialized nations shows that it is increasing prosperity that results in smaller families. On the other hand, poor families, and especially peasant families, need many children as their only source of labour, and also for security in their later life. So creating prosperity would see to the leave priority. But how is this possible, if the increasing gross national product is latent up by the increasing population?

Critics of capitalism maintain that the necessary goods are indeed produced, but are not fairly distributed. This brings me

to what I planned to say about the ideological conflict. The so-called bourgeois revolution also aimed at freedom from governmental tutelage in the economic sphere. The doctrine of a market economy, as developed by Adam Smith, is anti-authoritarian in its basic attitude. Experience has, indeed, shown that a market economy produces more and better goods than any planned economy under bureaucratic management, for the simple reason that a market economy activates the intelligence and initiative of many more people. But the market itself does not distribute goods evenly; the misery of the workers in the early stages of modern industrialism is common knowledge. Karl Marx expected from socialism fair distribution on the economic plane and the fulfillment of personal freedom on the social plane — about the exact opposite of the bureaucratic systems established later in his name.

The Problem of Social Inequality

In the industrialized nations of the Northwest, it has been possible to mitigate the problem of social inequality and to limit dire poverty to a minority, which, however, is now growing again (permanently unemployed and ethnic groups). This was made possible by the constitutional state, freedom of speech and representative democracy together with freedom of association, the right to strike, and social legislation. Nothing of the sort can be envisaged for the world market unless there is a comparable reconciliation of conflicting interests on a world-wide scale. This would necessitate three things:

1. the establishment and preservation of world peace,
2. a system of effective international law
3. an enforceable policy of conservation

of the environment achieved by international agreement.

If mankind is to be saved, we dare not aim at anything less. If we are not to deceive ourselves, we must, of course, be careful not to underestimate the influence of different cultural traditions.

Thus, problems seem to be surmountable in all market economies controlled by East Asians.

The imperative necessity of world peace has now become clear to us once again. The political authority that here has the prime responsibility is to be found in the United Nations. It is, of course, true that in this organization there is a constant tension between the interests of the powerful minority of northern countries and the largely powerless majority of the South. Yet the prevention of local and regional wars remains a common interest. It is, unfortunately, not possible here to discuss other very urgent problems, such as the remission of debts. And after having spoken about the need for a just distribution of goods, I can here only mention the other equally important element of a just society, human rights. A government that does not respect human rights is afraid of its own citizens, and it knows why.

The Preservation of the Environment

The technological revolution is now bringing to completion something that began with agriculture and the river-valley cultures, that is to say, mankind's radical transformation of animate nature on the surface of the earth. The effects of technology today achieve the dimensions of changes in the natural climate. Consider, for example, the greenhouse effect resulting from the senseless burning within just a few centuries of fossilized

substances that needed millions of centuries to accumulate. If asceticism means renouncing the use of goods that are technologically accessible, then an ascetic world culture has become necessary. This does not mean returning to cultures earlier times that were plagued by poverty, disease, and violence; it simply means acting in accordance with common sense; it means organizing a practical application of our technology such a way as to give due consideration both to the consequences that we desire and to those that we do not. Anyone who is indifferent about this matter is either a fool or an irresponsible criminal. A society cannot demand anything less of itself.

We have only a few decades in which to do what is necessary and possible. In a constitutional state it should be possible to undertake whatever measures may be necessary to prevent any damage or pollution caused by factors on the territory of this state. The legal principle according to which the person who causes damage must bear the cost can be applied to make the pollution of the environment a punishable offence.

Taxation reform on ecological principles could be still more effective. It might for example afford the competitive advantage to renewable energy sources which do not exist at present.

The crucial task is to achieve an international agreement. The effects of pollution are worldwide, crossing national frontiers. And pollution control in one country might put this country at a disadvantage in the competition for world markets. Here we see once again the necessity of worldwide regulations; and this means that public opinion throughout the world must become aware of the gravity of these problems.

The foregoing article is based on the address delivered by Carl Friedrich von Weizsäcker in Stuttgart in 1989 on the occasion of receiving the Theodor Heuss Prize. At the beginning of his address the prize-winner spoke as follows:

"Justice, peace, and the preservation of the environment constitute the theme of the Christian World Assembly to be held in March, 1990 in Seoul, Korea at the invitation of the Ecumenical Council of Churches. The formulation of the theme, therefore, derives from the religious, from the Christian sphere. In 1965, on the occasion of the first ceremony awarding the prize, the Theodor Heuss Foundation formulated its aims in the words, 'the just use of freedom'. What does the just use of freedom mean, if not the establishment of

peace in justice, and the preservation of the natural environment in which we live? But freedom as the designation of a basic value of the human community derives from another source of our traditions in the western world, from the political Enlightenment, and especially that of the 18th century. Today, in the year 1989, we remember the great outburst of hope of freedom 200 years ago in the French Revolution. I am myself now closely associated with the work of the church to achieve peace, justice, and the preservation of the environment. Therefore, I gladly take advantage of the opportunity to discuss these questions in the light of the political Enlightenment."

English translation by Greeley Stahl

Human Rights vs. Reason of State: International Law On the History of International Institutions

Otto Kimminich, Regensburg

From the beginning human rights have had a difficult time getting embodied in institutions. Whereas such ideas as the constitutional state, the belief in a God, and social awareness have found visible expression in powerful institutions — the system of justice, church, welfare organizations, and social legislation — the human-rights idea is almost always concealed behind legal instruments, political principles, motives for actions which are effective in a number of existing institutions. An institutionalization of human rights can only be made out late in mankind's history, in the written constitutions of the modern era and in the most modern trends of international law.

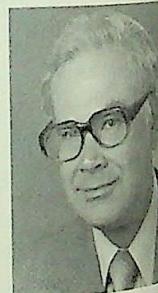
But this must not induce us to regard the history of human rights as a history of non-binding philosophical principles or indeed utopian dreams. Historical research shows that the idea of human rights can have political effects even without being institutionalized.

The State — a Machine?

Historians and political scientists agree that the modern state is characterized by a power apparatus. The state — a machine! This comparison was meant to express that the affairs of state took their course without friction, controllably, and in accordance with a programme. But

soon it was found that the comparison had a much deeper connotation. The modern state, which was perfected in the age of absolutism, was also similar to a machine in that it degraded man to a cog in the huge machinery, and the monarch was the one pulling the lever.

Prof. Otto Kimminich has held the Chair for Public Law and, in particular, International Law, Constitutional Law and Politics at the University of Regensburg since 1967. From 1963 to 67 he held the Chair for International and Constitutional Law



at the Ruhr University of Bochum. From 1951 to 1963 he was a lecturer in public law at the University of Würzburg. He also studied economics at the University of Virginia. His books include: *Einführung in das Völkerrecht* ('Introduction to International Law'), 3rd ed., 1987; *Schutz der Menschen in bewaffneten Konflikten* ('Protecting people in armed conflict'), 1979; *Rechtsprobleme der polyethnischen Staatsorganisation* ('Legal problems of polyethnic state organization'), 1985; *Umweltschutz — Prüfstein der Rechtsstaatlichkeit* ('Protecting the environment — touchstone of constitutionality'), 1987.

Prof. Dr. Otto Kimminich, Killermannstrasse 6, W-8400 Regensburg, Germany

The practice of ancient democracy in Greece and ancient Rome, imbued with Greek philosophy, the communal legal concept of the Germanic peoples, and the ideas of Christianity created states which were fundamentally different from the human machines of ancient despotism. Solely the institution of slavery, which almost completely lost all significance even during the Roman Empire, was a last reminder of the tyranny under which the peoples of the Eastern Mediterranean must have languished for so long.

The increasing barbarity of the wars fought since the mid-19th century and the horrible atrocities in national and international politics — persecution of minorities, racism, mass expulsion, colonialism, purges, pogroms, concentration camps, political persecution — make it difficult to differ with the opinion that modern technology has provided the modern state with means of suppression far surpassing the tyranny of the pharaohs. It would indeed be naive to think that modern technology has brutalizing effects of its own accord. Intellectual processes must have taken place which led to that turn of events. The causal connections have by no means been exhaustively studied. In such a situation, pessimism becomes rampant. One tends to think that the idea of human rights cannot prevail against the reason of state.

But the struggle against the omnipotence of the state is at the very heart of the idea of human rights. This was already true in the age of absolutism, and it is that much more the case with the modern state. That this direction of thrust by human rights is more noticeable in the totalitarian state than in democracy, is obvious. As a concept, it is always present. But that is precisely the major problem in the institutionalization of human

rights. How can an intrastate constitutional system institutionalize something which will ultimately oppose the state? How can an international system of law which is in its essence a system of law of the sovereign states establish and maintain institutions limiting the power of the sovereign states, thus lessening the significance of sovereignty and transferring what was hitherto the exclusive jurisdiction of the states to the jurisdiction of an international institution? That would be like taking the innermost essence of the states and turning it inside out. Thus, effective protection of human rights at the international level is obstructed by the structure of international law. Since its inception, international law has at no time been a law of the peoples. It was conceived as the law of intercourse among the sovereigns and then became the law of that of sovereign states. This has remained thus to this day. Even today, the subjects of international law are solely the sovereign states, the international organizations founded by them, and a few special institutions. The individual has no direct function as a legal entity at the level of international law. "His" state, i.e., the country of which he is a citizen, acts as intermediary.

Here it is already clear how difficult the situation is for a person without national citizenship or an international refugee who no longer enjoys the protection of his state. All attempts to procure an international legal status for individuals such as this, i.e., in the framework of international law, at least in this area where the individual indisputably has no sovereign state as his intermediary at the international level, have thus far failed. The norms of international refugee law, which have been established by a great number of treaties in the course of more than six

decades, act in favour of thus affected individuals, but do not make them legal entities.

The Dilemma of Human Rights

This is the dilemma of human rights on the whole: at its present state, international law can obligate the states to a certain conduct towards individuals, including their own citizens, but it denies these individuals status as legal entities in defence of their own rights. In particular treaties, the sovereign states can of course concede further rights. The Western European states did so with the signing of the Convention for the Protection of Human Rights and Fundamental Freedoms of November 4, 1950, which went into effect on September 3, 1953.

On December 10, 1948, the General Assembly of the United Nations approved the Universal Declaration of Human Rights. As great as the strength of its moral appeal may be, it has no legally binding effect. In cases where it was at issue, the states have always pointed this out, and no one can prevent them from doing so. Since on the basis of its structure universal international law has no institutional protection of human rights, legal obligations can only be established by treaties between sovereign states.

Among these treaties is of course the Charter of the United Nations, which went into effect on June 23, 1945. In several passages it embraces human rights. In the Preamble the member states avow their "belief in the fundamental human rights, the dignity and value of the human personality, the equality of man and woman." Article 1, section 3 declares international co-operation for the purpose of "promoting and encouraging respect

for human rights and for fundamental freedoms for all without distinction as to race, sex, language, or religion" to be one of the purposes of the United Nations. Article 13, which deals with the individual steps for promoting international co-operation and the codification of international law, obligates the General Assembly to include in its activities the sponsoring of studies and handing down of recommendations "assisting in the realization of human rights and fundamental freedoms for all without distinction as to race, sex, language, or religion." The same wording recurs in Article 55 c in the enumeration of the economic and social goals of the UN. In Article 56 the member states pledge to "to take joint and separate action in co-operation with the Organization for the achievement of the purposes set forth in Article 55."

However, the Charter's commentators have for the most part arrived at the conclusion that as far as human rights are concerned, the UN Charter only contains declarations of principle which are not legally binding. The member states are only vaguely obligated to do something to assure that human rights are respected and realized without stipulating in detail what should be done and what human rights are involved. This is precisely what the Universal Declaration of Human Rights of December 10, 1948 is so significant. It enumerates the human rights the UN Charter had in mind, defines them and confirms that the member states are obligated to enforce them. But, as remarked above, this declaration has no binding effect. As a resolution of the General Assembly, it is merely a recommendation, the disregarding of which cannot be punished.

The slight practical significance of the Universal Declaration of Human Rights

was a disappointment to all who had counted on the UN's swift intervention in the field. But this also encouraged the proponents of the human-rights idea to take further steps without delay. It had been obvious from the start that the Universal Declaration could only be the beginning. Further possible steps were: 1) moral pressure through further recommendations; 2) legal obligation by multilateral treaties; 3) authority of international bodies and organizations to issue directives.

The second step had already been prepared before the Universal Declaration was adopted. Already in 1946, work on a human-rights covenant was begun. Eventually there were two: the International Covenant on Civil and Political Rights and the International Covenant on Economic, Social, and Cultural Rights. Both were signed on December 19, 1966 and submitted to the ratification process. They were to go into effect three months after deposition of the 35th certificate of ratification. It was ten years before this condition was fulfilled. The fact that of the then over 150 member states of the United Nations not even 35 were willing to ratify the UN human-rights covenants in ten years, should make one pause to think. The covenants went into effect in January and March, 1976, respectively. As of today, 81 states have acceded to the Covenant on Civil and Political Rights and 85 to the Covenant on Economic, Social, and Cultural Rights.

The Quest for an "Amicable Solution to the Matter"

An international institution for implementing the obligations of the states set forth in the human-rights covenants does not exist. In accordance with Article

28 of the Covenant on Civil and Political Rights, a Human-Rights Committee has been established, but its authority has been so narrowly limited in favour of sovereignty of the states that it can scarcely be regarded as a control body which is capable of functioning. Apart from the functions of informationgathering and reporting, its main task is to seek an "amicable solution to the matter" in cases of alleged human-rights violations. In the Covenant on Economic, Social, and Cultural Rights a system for filing reports is all that is provided.

But it would be unfair to judge the achievements of the UN in the field of human rights solely by the Universal Declaration and the two human-rights covenants. As an organization, the United Nations has not only continued the work of the League of Nations in areas involving the protection of human rights, such as the previously mentioned rights of international refugees, but has also taken many new initiatives. Take, for example, the Convention on the Prevention and Punishment of the Crime of Genocide of December 11, 1946, the Convention on the Non-Applicability of Statutory Limitations to War Crimes and Crimes against Humanity, and the Declaration on the Elimination of All Forms of Racial Discrimination of March 7, 1966, to name only a few of the multilateral treaties.

Moreover, the activity of several bodies and special organizations of the UN involves individual human rights. Examples are the Trusteeship Council, the Economic and Social Council, the UN High Commissioner for Refugees, the International Labour Organization. However, there is no special organization for the protection of human rights. The idea of a High Commissioner for Human Rights on the model of the High Com-

missioner for Refugees has been under discussion for some time inside and outside the UN, but the prospects for its practical realization continue to be dim. Sovereignty continues to hold sway. It seems intolerable to the states that an international authority should oversee the way they treat their own citizens. In other words, international protection of human rights has yet to cross the threshold of sovereignty.

No Legally Binding Effect

The Final Communiqué of the Helsinki Conference on Security and Co-operation in Europe (CSCE) signed in August, 1975, has not altered this fact. It is not a treaty of international law, but merely the final communiqué of an international conference containing certain declarations of intent. These declarations have no legally binding effect. Reproaching a state for violating the CSCE final communiqué is thus insignificant from a legal standpoint. It does not amount to a reproach for breaking the law. The CSCE final communiqué could thus not think of establishing a control authority. The continuation of CSCE conferences, at which human-rights issues are discussed, only amounts to a negotiating forum and is not an institution for the protection of human rights in the legal sense. This is not to detract from the political and moral value of a forum of this kind. But one should be careful not to misjudge its legal status.

Real progress beyond universal international law has been achieved by the European Convention on Human Rights. It has established the foundations for a system for protecting rights that is first of all integrated in the organization of the Council of Europe as a whole and in ad-

dition has special bodies for the protection of human rights the European Commission on Human Rights and the European Court of Human Rights. Unfortunately, the original plan to grant individual persons access to the Tribunal could not be realized. But nonetheless, the individual has the right to lodge a complaint with the Commission, inasmuch as the signatory state against which the complaint is lodged has recognized the Commission's authority. This has been decided as of now by 19 of the 21 signatory states.

However, the complaint is only permissible after all local remedies have been exhausted. It can thus indeed be said that this entails a long journey through the courts. When the Commission accepts a complaint for jurisdiction, it first studies the matter, which requires the assistance of the states in question and is at the disposal of the parties involved so that an amicable settlement of the matter can be reached based on the respect of human rights as stated in Article 28 of the ECHR. If this is successful, the matter is concluded with a report. Otherwise, it just reports the matter under dispute and hands down an opinion on whether the established facts show that the state in question has violated its obligations as set forth in the Convention. This report is to be submitted to the Council of Ministers (ECM) of the Council of Europe and to the states in question.

At this point, the matter can be transferred to the European Court of Human Rights for legal proceedings. However, this does not occur within three months after submission of the report to the Council of Ministers, it decides whether the Convention has been violated or not. If a violation is found to have occurred,

the Council of Ministers must determine a period of time within which the state which has violated human rights must carry out the steps stipulated by the Council of Ministers. If the state in question does not carry out the steps within the stipulated period, the Council of Ministers once again decides, this time as to how its original decision is to be implemented.

Apart from the individual complaint, the ECHR also provides for the state complaint, i.e., the complaint of one signatory partner of the ECHR against another because of an alleged violation.

Direct Guarantees

With the direct guarantee of human rights and the provision for lodging complaints and for legal proceedings, the protection of human rights has reached a higher level of development in Europe — or more precisely: in the greater portion of Western Europe. This may be a source of satisfaction to us, but it must not induce us to be content with what has been achieved thus far. Further efforts will not only involve increasing the number of human rights under guarantee and elaborating the individual rights more precisely, but also improving the system of legal protection, in particular making the Court of Human Rights accessible to individuals.

A counterpart to the ECHR is the American Convention on Human Rights signed by the Organization of American

States on November 22, 1969, in which the states of North, Central and South America take part. It, too, has established two control bodies: the Inter-American Commission on Human Rights and the Inter-American Court of Human Rights, with which likewise only the signatory states and the Commission may lodge complaints. The Court began its activity in 1981.

Thus, the sum total of more than 60 years of activity of international institutions for the protection of human rights is disappointing. But two generations aren't much by the measure of world history. State sovereignty, which has been the main pillar of the system of international law for three hundred years, cannot be supplanted overnight. Also, it must be remembered that this fundamental change must be arrived at peacefully. The convulsions it involves give rise to major problems precisely in a peaceful context, and they will require much time to solve.

This admonishment to patience at a time when — as we all know — human rights are being ignored in many countries of the world, must not be misinterpreted as an appeal for resignation. The great phase of upheaval in which international law has been since the end of World War I has not yet reached completion. There is still hope that international law will be transformed in our time from a law of states to one of humanity.

English translation by Philip Mattson

The Foreign Citizen

Rules of the Game for a Republic of Many Peoples

Claus Leggewie, Gießen

Multicultural might have become the "word of the year" for 1990 but for certain expressions regarding the Berlin wall and financial assistance for new arrivals from East Germany that have gained wide currency. The former secretary-general of the Christian Democratic party, Heiner Geißler; the first red-green multi-cultural departmental head, Daniel Cohn-Bendit; the Christian Democratic burgomaster of Stuttgart, Manfred Rommel; and the Social-Democratic politician in the field of culture, Hilmar Hoffmann, among others, have all, freely though not always with impunity, made use of this apparently harmless, yet emotive, word.

People in Germany now usually associate the idea of multicultural with food and eating. One writer in some brief remarks recently recounted some typical gastronomic experiences as follows: He had stopped at a forest guest-house that was run by Italians, whose bill of fare, however, besides Pizza, also included Schnitzel (veal cutlets). Now the cutlets were prepared by Indian cooks, — or were these cooks from Pakistan? At any rate, the cooks did not eat the veal cutlets that were prepared for guests. For themselves they had rice with a marvellous fragrance from steaming dishes, something which, at last, made our German potato eaters rather envious.

The Kebab principle

Foreign scents and seasonings are certainly welcome additions to our culinary resources. Indeed, the kebab principle, a collage, as it were, of foods from diverse symbolic contexts, can certainly be conceived as a model of the multicultural world society that is now developing. Yet people who are multicultural in their eating habits are usually not very talkative and will usually prefer to digest in silence what they have consumed. And so, the diversity somehow passes away, as we swallow our food with pleasure or chew with our teeth.

Professor Claus Leggewie, born in 1950, studied history and the social sciences in Cologne and Paris. Since 1989 he has been professor at the Justus-Liebig University of Gießen. His latest publications include „Die Republikaner, Ein Phantom nimmt Gestalt an“ (Berlin, 4th edition, 1990); and „MultiKulti, Spielregeln der Vielvölkerrepublik“ (Berlin 1990).



Professor Claus Leggewie,
Alter Steinbacher Weg 10, 6300 Gießen/Germany



To the West with only the most essential things.

(Photo:dpa/Felix)

Pursuing a Head-in-the-Sand Policy

According to statistics, around 850,000 people immigrated to the Federal Republic in 1989, as follows: 380,000 came from countries of eastern Europe; 350,000

from East Germany, besides 300,000 more in the first three months of 1990; and 120,000 seeking asylum from all over the world; the majority from eastern Europe. That almost amounts to the population of a city of a million people, or

of 20 cities of medium size or of 500 new villages. This is, indeed, a tremendous number for a country that, according to official pronouncements, is not a country for immigrants. The fact is that we now exceed the immigration quota of the United States. Curiously enough, hardly anyone calls these people immigrants. Regarding those of German descent, it is simply said that they have been evacuated and changed their place of residence. And of the others it is said that only a fraction are recognized as political refugees, (at present, about one in twenty), and it is further alleged that even these will remain only a short time. This attitude is like the behaviour of the ostrich that hides its head in the sand. The labels are misleading, and we should now face the facts. The German Federal Republic is now, and will remain, a country for immigrants. Since the middle of the century, the number of people leaving to emigrate has no longer exceeded the arrivals.

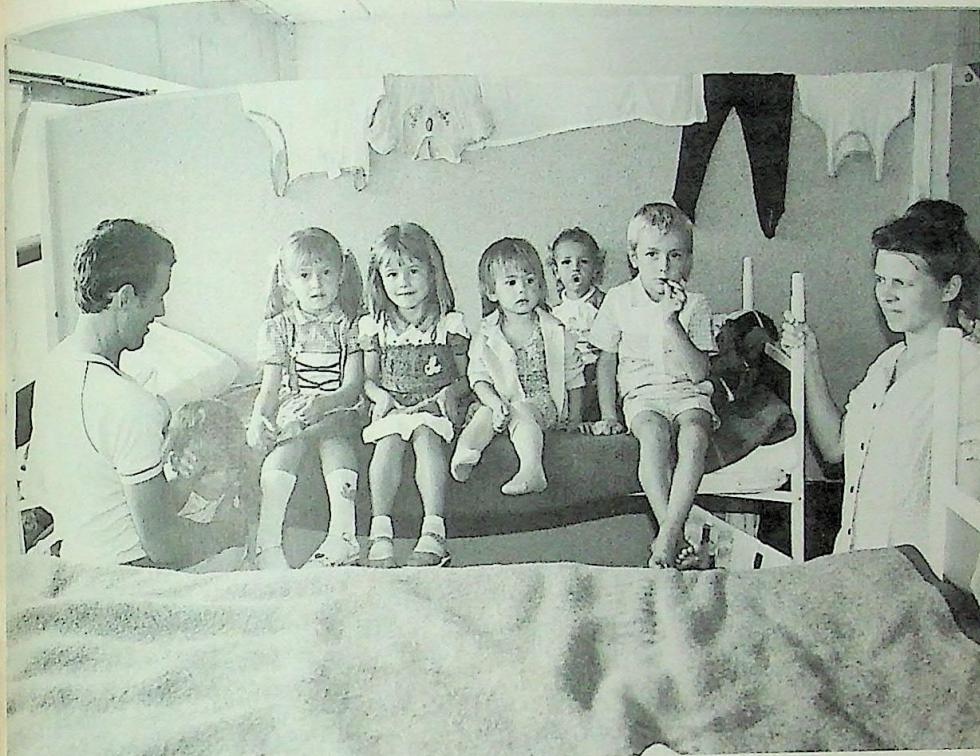
The first people to arrive after 1945 came because they had been expelled from their homes in the Reich that had been destroyed; Germans yet also immigrants of a very particular kind. This particularity is shown by the fact that they have here grouped themselves together in "colonies", and that they have their pressure groups which today are still very effective. One might also mention their various associations for cultural purposes. And it is particularly noteworthy that their descendants born here can inherit the status of being an expellee.

This trek from East to West was followed by a second one consisting of workers from southern Europe and the Mediterranean region in its larger extent. Although since 1974 they have no longer been recruited and despite the subsequent crisis, these people have not accepted the

provisional status of flexible foreigner that was intended for them. Most of them have either had their families join them here, or else married here, when they have begun their family life. Their children and grandchildren, who were born here we call the "third generation immigrants", and are, at last, beginning to understand that the overwhelming majority of them want to remain here as will.

The third immigration comes from regions of the Third World. At present countless thousands of Asians, Africans and Latin-Americans, for many different reasons, live in West Germany, and, individually, some of them may even be found in the eastern part of the country though this region, with its policy of rotation, has been just as hostile to foreigners as Franz Schönhuber and his followers could wish.

And now we have the fourth wave of immigration, once again an immigration of people of German ancestry. (I must say, however, that this word "wave", suggesting a veritable inundation, is not at all to my taste). The truth of the matter is that, despite continuing immigration and the overcrowding in emergency reception camps, the proportion of foreigners in Germany is, on the average, not greater than it is in most of the other countries of the European Community. Contrary to the impression of being crowded closely together that some people have, the border is not filled any more than it would be in the case of that normal demographic development which some population strategists have always maintained to be absolutely necessary, if the German people are not to die out. The GDR with its very small proportion of foreigners and, at the same time, its very marked hostility towards foreigners shows in a particularly striking



(Photo: Süddeutscher Verlag)

Is the boat full?

way that the problem is not in the number of people involved, that is to say, is not determined in terms of magical thresholds of tolerance. (Incidentally, everyone in France is now talking about such thresholds, even the liberal humanist, Francois Mitterand.) The idea that these most recent settlers are not really immigrants, and that, therefore, our society is not a society of immigrants, is a biological myth and a legal fiction; it is an idea that is now crumbling as a result of the presence of these settlers. From a sociological point of view, immigrants of the white race whose native language is German do not behave very differently from coloured immigrants who are crowded into similar emergency shelters in the same vicinity. One feature of this behaviour, among others, is the internal

pecking which develops between expellees of the past and latecomers, between those who were evacuated and those who have come voluntarily. And all these people have an aversion to the foreigners who, even if they were born and brought up in Germany, allegedly do not belong here. This is what happens in a society of immigrants, scuffling and wrangling from the beginning. And the reaction of the natives to both these groups is essentially the same, a reaction of xenophobia against people who allegedly and according to Constitutional Law are one's own people. In short, this is a sort of internal racism in which no foreign race is involved. It must be said, however, that Germany is by no means the only country where this phenomenon is to be found. In Italy the so-called "good Ital-



"Germany, united fatherland" – German or multi-cultural?

(Photo: dpa/Wolfgang Weh

ians" rebel not only against the Arabs and Africans who swarm across the Mediterranean in such large numbers; they also rebel agianst the allegedly bad Italians: terroni al rogo! The people from the poor regions of the South should be burned at the stake, according to north Italian electoral leagues, consisting of dyed-in-the-wool federalists who would prefer to be free of Rome, and to detach themselves from the South with its notorious mafia. These north Italian leagues have, in fact, achieved sensational success with their inner Italian apartheid. Perhaps that will be the fate of Europe: the whole of Europe against the rest of the world; and within the continent, everyone against everyone else.

Open the Door – but for whom?

Granting them all moral and political rights, we now open the borders wide for Germans, albeit seething inwardly, – and are we at the same time to close them for immigrants and refugees from all other parts of the world? And why is it that Germans who have just arrived are able, within 24 hours, to enjoy all civil rights, active and passive? And, on the other hand, why is it that non-German immigrants and refugees have been waiting for 24 years to acquire these rights, and that if the present situation continues, their children and grandchildren will have to wait for another two generations? We still adhere to the rigid viewpoint that native

without a German passport are not citizens, and, therefore have no right to vote or to take an active part in political affairs. Bearing in mind that the word define literally means delimit, I ask: How do we define membership of this political community which has now arisen in Europe as the successor state to the Federal Republic of Germany and the German Democratic Republic? Does the emphasis lie primarily on „Germany, our united fatherland“, or, as I advocate, should this new political entity become an open republic of many peoples? Such a development would be in harmony with the origin of the two German states, which were “post-national” in their conception. A republic of many peoples, — these words give expression to my conception of a political form that has still to be created of a “multicultural society”; and by this I mean something more than the intermixing of peoples and races now taking place, and concerning which malevolent remarks are so often made. Integration and autonomy, — that would be the formula for a republic of many peoples, a formula, however, which probably involves a contradiction that cannot be resolved. By this I mean a society that integrates foreigners without doing violence to them by weakening or destroying their cultural identity; a political community that, when confronted with social divergencies arising from different ways of life, is able to adjust these divergencies within the peaceful framework of a civilian society, yet, at the same time, bringing about this adjustment in such a way that essential differences of mentality and custom are left untouched. In short, the ideal should be integration within the framework of society, yet without any ruthless measures to enforce uniformity; and, on the other hand, autonomy without the ignorant relativism of

people who decide everything for themselves.

So Near and yet so Far

What is needed is an attitude that avoids the two extremes of, on the one hand, completely rejecting these foreign elements or, on the other hand, simply swallowing them whole. Would it not be possible to envisage for German society this less radical position? In a beautiful text, written in 1908 and now classic, the sociologist, Georg Simmel, writing with reference to the experience of European Jewry, characterizes the social position of the foreigner as “both near and far away”. The foreigner brings new elements into societies that consider themselves to be homogeneous. (The word homogeneous, let us remember, means derived from the same origin.) These qualities distinguish him from the natives, and cause him to be regarded as different. This is already shown by his external appearance including physiognomy and deportment, clothing and other unusual characteristics. In a sea of conformity and routine constituted by other people like ourselves, he stands out as a singular individual. It is hardly possible to regard him with indifference. Most people react in a way that is either friendly or hostile. The xenophiles are attracted by what is novel, exotic and unknown in their previous experience; they see the possibility of making comparisons and picture to themselves possible metamorphoses. Foreigners who give such delight have been, from time immemorial, people who are constantly on the move, including goliards, people of extravagant tastes, troupes of travelling players, itinerant circuses, bearers of joyous news and other storytellers; all of them revealing possibilities beyond our previous experience.

For Georg Simmel the foreigner was the person who was always prepared to move on, a wanderer, "who comes today and remains tomorrow — the potential wanderer, as it were, who, even if he has not yet moved on to another place, has not really overcome the rootlessness of coming and going". He holds out the prospect of a blissful way of living that lies beyond present circumstances, of breaking loose from the roots that one has put down, of a new adventure for all people who have abandoned hope of experiencing anything out of the ordinary, and a step forward for people who are bogged down in routine. This is the direction in which political visions have aimed: the improvement of conditions in Central Europe through the immigration of foreigners. Of course, people who think in this way are projecting illusions into their conception of the foreigner, ennobling him and making him their model for a better and more successful way of life; but such partiality can easily change to antipathy when these hopes are not fulfilled, and inevitably they are not. As we approach the foreigner, his foreignness seems to disappear, and, at the same time, we become aware of our own foreignness in relation to him. We now have the uneasy feeling that we are foreigners.

And so, from time immemorial, the foreigner has always been a disquieting phenomenon: perhaps a thief, a voyeur, the perpetrator of some outrage, a beggar or a spy; someone who, in one way or another, aims at plunder and, in the long run, is just one more mouth to feed. According to one etymology of the word, foreigner is synonymous with enemy, that is to say, a robber of our property. Consider, for example, the archaic pictures of gypsies and dark-complexioned seducers. We can thus understand the ori-

gin of certain political visions by way of reaction. The eugenic ideal of a national community of one people is an utopian conception carried to the ultimate extreme; with its emphasis on racial purity, it signifies the exclusion of all foreign elements from our society.

Within the Warmth of the National Community

Racialism arises from fantasies of self-pollution and of the inundation of the society to which the self belongs. The racialist develops precautionary measures with a view to protection communities from foreign influence and domination. He always conceives himself as a defender, as the preserver of something that is threatened from without, as a voice admonishing all those who remain indifferent to his warnings. This is an excitable state of mind, which, of course, it is difficult to argue against, as it meets with general agreement. Today there are new causes of unrest: the extreme mobility of world society, transnational business relations, tourist traffic throughout the year and the constant transmission of signals show in the most striking manner how open the territory of one's own country has become. Countless numbers of foreigners, including people in miserable conditions, stand before so-called boundaries which, in fact, are not really boundaries any longer. Criminal attacks made by foreign terrorists, religious fanatics who call for a holy war, and epidemic diseases like AIDS, (whose origins are, of course, attributed to foreign countries), — all these things, according to the racialist, "prove" that his country is without protection. In the perception of the racialist, his own body, the primary covering of the individual, is in mortal danger. He, therefore,

pleads the protection of the national community as a protection against this. Today, however, physical elements, such as blood, genes, the shape of the body, etc., receive less attention than cultural characteristics; the assertion of racial superiority gives way to a recognition of the equal validity of different cultures. The modern racist speaks of the "threatened peoples", by which figure of speech, with all modesty, he particularly means his own. The rejection of foreign elements is considered just as inevitable as the fear of strangers that little children have at a certain age, with, however, the essential difference that national communities, like Palaeolithic tribes are always in this state of mind.

On the other hand, anyone who opposes this attitude with the sweeping generalization that foreigners are really just "people like you and me" is making things a little too easy for himself. Opposition to racism cannot be carried on in such simple terms, and anyone who attempts to do so thereby avoids the effort that is needed to perceive the essential differences involved. There is also the attitude of the man who professes that he can get along with foreigners better than with his own people. But this is to play the role of the snob who has renounced his own individuality and puts on the airs of a jovial protector. The two attitudes, respectively known in European cultural history as cosmopolitanism and exoticism, have this in common that both keep foreign elements at a distance; in one case, by denying their existence; and, in the other case, by giving them a particular status. Consider the well-meaning stereotypes of foreigners that have now gained currency among us, and that are to be found in television, in the literature regarding foreign workers and in pro-

grammes of political education. These are crude, oversimplified images that make a mockery of the complicated reality of a country that for many years has been receiving large numbers of immigrants. Of course, the most well-known book about Turkish immigrants in this country is now "Ganz unten", by Günter Wallraff, in which the author recounts his experiences during the time when he was disguised as a Turkish workman by the name of Ali. In its description of the deplorable conditions in which many Turks live and work, there is nothing in this book to contradict.

Going Back to One's Roots

There are some people who feel that the presence of so many foreigners gives them the opportunity to acquire a new consciousness of their own forgotten identity. The idea behind this attitude is that a "multicultural" way of living is possible only for someone who knows what he himself is, and can, therefore, make his own contribution to a life of this kind. The presence here of people from Alentejo or Anatolia or Vietnam is for many Germans a reason to show more clearly whatever comes from their native locality, whether this be Bavaria or Mecklenburg or Cologne. There is an inclination to go back to one's roots, and to compensate for the standardization resulting from modernization by cultivating and cherishing old customs and traditions. By this attitude, however, an opportunity is missed. Being at the same time near and far away can no longer give us a fixed identity, a firmly grounded sense of individuality attended with a generally tolerant attitude toward the different characteristics of other people. What is needed is not a return to one's roots or a will to ignore differ-



Cultural self-expression of the different ethnic groups is permitted, but political participation is obstructed.
(Photo: Süddeutscher Verlag)

ences, but the acquisition of a sovereign skill in taking advantage of the many possibilities both for breaking free and for forming new associations. The benefits of a multicultural community are not to be sought in the sum total of all the elements it is said to have, but rather in the network of its changing relations and intersections. Societies which pluralistically distance themselves from one another (and which in this way first really become societies) are not dependent on the theatre for the way to better understanding; a certain detachment is necessary for objectivity and the ability to judge. That is why for Georg Simmel the judge was the ideal type of the foreigner. In the hurly-burly of modern life this is conspicuous as an ideal; yet the reality of city life today is

just like the colourless monotony of country life.

An educational programme for natives and foreigners that overemphasizes separate identities and clear-cut differences together with political communication orientated towards national cultures, no longer makes any sense in multicultural societies. The mixture and interpenetration of these elements, accelerating every day, gives rise to the thought that the resident alien no longer needs our feelings of compassion as a "problem", as a warmer "between cultures". The fact is that between the different cultures a fascinating world of new forms is now developing. In music, in literature and in pictorial art, multiculture, in the strict sense of the word, is now developing. And in daily

life, more particularly in the daily life of youthful immigrants, a third something is now developing that is compounded of multifarious elements, indigenous, brought from the country of their origin, newly rediscovered or, in some cases, already truly transcultural. It is, however, true that such creations often disappear as quickly as a new fashion. Cultural practice can provide a locus for a social movement, perhaps even for a political movement against racism.

The Foreigner as Citizen

The point made by Simmel is that the foreigner, precisely because of his exceptional mobility and objectivity, brings to mind general principles of equality. Our relations with him necessarily have an abstract character owing to the fact that "one has only certain general characteristics in common with the foreigner, whereas, on the other hand, the relationship with people to whom one is organically bound, is based on the similarity of specific differences as against that which is purely general". In immigrant societies such as ours, this is the very significant abstraction of cultural diversity. With this in mind, the burgomaster of Amsterdam, Ed van Thijn has asked what is to be done with the many foreigners who consider naturalization the most important sign of democracy. The multicultural idea was borrowed from the field of pedagogics; it sometimes has the aura of a naive programme for international understanding, and other manifestations include the taste for a certain kind of very informal dancing (as Thomas Schmid has pointed out). The time has now come for this idea to lose the simplicity which has hitherto characterized it. All people who advocate a multicultural society expect enrichment

in one way or another from contact with foreigners. Take, for example, the employers, who, frankly and unabashed, call attention to the shortage of native workers. The higher city officials value the "colourful cultural society", (a quotation from the 1986 CDU programme for the future), as one attraction among the cultural offerings that they must offer, if business managers and the new middle classes are to feel that their travels have been worthwhile. Exotic food is valued as a source of new gastronomic delicacies; interior furnishings and foreign addresses as stimuli to enliven the grey monoculture of everyday life. In tourism in foreign countries and in advertising, the world has already been multicultural for a long time. An advertisement for cigarettes with the words, "Come together and learn to live as friends", is an example of this. According to this idea, all people are good friends and together learn from one another. The world is thus conceived as one permanent workshop of exoticism, Babylon as home. In fact, however, the reality is rather more complicated than this. The way of life of a national culture cannot be treated as a nature reserve. Moreover, emigration has always entailed a certain violation of identity, and on both sides. Therefore, although this idea is relatively progressive from a political viewpoint, inasmuch as it is in accordance with the trend to modernize world society, it is, apart from this consideration, nothing more than soap-box oratory. Babylon cannot be one's home. In the building of today's tower of Babel the apocalyptic nature of Babylonian chaos is to be seen once again. The great international movements are collapsing at the very time when global economic interdependence is increasing.

Now that world society is developing

without world police, we are once again confronted with the problems of conflict between nationalities and ethnic tensions. The great imperial models of republics consisting of many peoples, that is to say, the United States of America and the Soviet Union, are in a state of ethnic regression. In the United States, cultural ethnocentrism is dissolving the melting pot, which has been the cardinal element of American ideology; and in the Soviet Union, political separatism is bringing Gorbatschow's revolution from above to the verge of failure, leaving its ultimate success in doubt. And Europe has not been spared internal tensions and aggressions for ethnic reasons; from the Baltic States to the Balkans many people dream of living in regions cleansed of foreigners. The Lithuanians and the Moldavians would like to get rid of their Russians; Bulgaria has already expelled its Turks across the border; the Greeks cry for action against the Turks; and in Kosovo the dream of a nation of many peoples is once again coming to nothing.

Likewise in western Europe it is becoming clear what conflicts are inherent in multicultural societies. Cultural coexistence works very nicely to the extent that it is simply a matter of eating and celebrating around a table; afterwards, everyone goes home and leads his own life as usual. Of course, leaving people free in this way to follow their own inclinations is certainly better than tutelage. The fact remains, however, that an attitude of friendly relativism is not always adequate in dealing with the complexity of the situation, and this has recently been shown in a number of critical incidents of a dramatic nature. Consider, for example, the burning in Bradford of the allegedly blasphemous work of Salman Rushdie, the "Satanic Verses", or the con-

troversy that shook France regarding the question whether Moslem girls should be allowed to wear the chador in French schools, to say nothing of conflicts that frequently occur in our own country. Khomeini's deadly arrow, still whizzing, is a terrible obstacle to the realization of all professions regarding the peaceful co-existence of different national cultures.

Civil Rights and the Preservation of Cultural Identity

Political significance can be attached only to something that goes beyond the rhetorical interplay between a provocative hostility to foreigners, on the one hand, and, in reaction to this, a friendly attitude towards these people, on the other hand. Before friendly relations can be established, one must first distance oneself, as it were; an attitude of detachment is a pre-condition of solidarity. In other words, the tolerant recognition of the differences must enter into a policy aiming at the maintenance of peaceful relations. Postmodern republics with a population of many different peoples can no longer regulate questions of inclusion or exclusion by centralized procedures, that is to say, by having territorial boundaries coincide with cultural identities; this would give rise to cultural implosion. Yet, on the other hand, these republics cannot survive by the simple coexistence of the various ethnic groups and cultures alongside one another. To advocate this would be to make a sort of liberal apartheid the multicultural ideal.

We are still very far from finding a reasonable middle course, and, in the meantime, we have nationalized the problem. As a general rule, political interaction takes the following form: A powerful state concerns itself with the foreigners in

is midst whom it recognizes as belonging to its "clientele". It grants, or refuses to grant, political and social rights ranging from a residence permit to social welfare benefits. And this clientele, dependent as it is on these rights, forms for itself associations that are ethnically self-sufficient and non-political but, at the same time, quasi-political pressure groups for its dealings with the state, as, for example, the advisory committees of resident aliens. Cultural self-expression and other forms of modern sociability are tolerated and even welcomed by both sides, such things as, for example, the Jugoslav football association and the Turkish tea-house. The rapid construction of so many mosques in Europe is a striking example of tolerance insofar as it is limited to religion.

At the same time, however, all general political participation is blocked, even at the lowest level; likewise representative bodies for purposes of mediation. This is already shown by the judicial refusal to grant foreigners the right to vote at the communal level. But public negotiation regarding controversial questions between natives and foreigners under democratic conditions is one of the essential functions of politics. Such negotiation can take place in parliaments and forum discussions, in the civil centres of municipal districts, as likewise in citizens' action groups, in self-help organizations, and perhaps even in institutions that have not yet been created. In smaller dimensions, as, for example, in elections for works committees, organizations for social security and school trusteeships, foreigners have long been active, even if not in political life. And here, cultural understanding does not necessarily lead to isolation; it can, on the contrary, become a means of participation in public life.

This can easily be seen in more experienced immigrant societies. The beurs — as the third generation of North African immigrants in France call themselves — want civil rights, but at the same time desire to preserve their cultural identity. They cling to their customs and traditions, and desire no change in matters of wealth, the generations or religion, etc., but they want an end to the relations of subordination and oppression that are bound up with these differences. An essential difference in comparison with our own system is that most of them automatically become French citizens.

What is the origin of this new ethnic consciousness, a consciousness which is not traditional and not necessarily "fundamentalist"?

Alleged Communities

If it is true that differences of class and social position are now fading away and that, to an ever increasing extent, people now behave as isolated individuals, whether in the production process, the utilization of services or the means of transportation, etc., the result is that certain essential, collective habits of mind and elements of solidarity are disappearing, albeit not the social segregation and discrimination on which they are based. Natural characteristics such as age, sex, physical condition, and innate ones including race, complexion and ethnic affiliation acquire, in the words of the sociologist, Ulrich Beck, "particular value for purposes of organization and politicization because of their inescapability, their temporal constancy, their perfect indifference to the achievement principle, their concreteness and their immediate perceptibility as means of identification".

However, ethnicity today, even in the

Third World, is not based on traditions inherited from the past. On the contrary, it has the red-hot up-to-date topicality of a new, artificially created tradition. What we have here, according to Max Weber, is the belief in an alleged community. Such communities are fictitious, but "true". Cultural identification is sought not only by immigrant minorities, but also by majorities, which, though in a stronger position materially, are unsure of themselves in a moral sense. The binary code of we-groups, the either-or nature of membership of such a group, is mutually strengthened.

Is not our proposal to mediate between these internal ethnic-cultural stratifications in the political sphere and to neutralize them a little too naive? One must at all times be prepared for the failure of the idea of democracy, for, in the last analysis, this is the root of the matter. It is, of course, true that the democratic idea, when it does not itself become the subject of a missionary passion or the cudgel of a Kulturkampf, has at least one fundamental advantage. Its principles are of a procedural nature, in other words, its substance bearing on freedom is a matter of its forms including such things as various rules (including rules of procedure) the right to make oneself heard at sufficient length, and the principle of majority rule together with the protection of minorities.

The great universal principles including Christianity, world-citizenship and a classless society have come to nothing. We no longer have any unifying principle of world-wide validity. Religious fanaticism and new nationalisms may well fill the void. On the other hand, the experience of alienation that has now become so frequent, together with the generalization in our century of the phenomenon of exile, in short, the permanent condition

of living on the periphery of society, has given us the freedom to change our place of residence, and also both to become aware of and sometimes even to overcome our narrow-mindedness. It is the foreigner that is the leitmotiv of modern socialization, the foreigner and not the utopia of homecoming and a society free of alienation.

Guests or Fellow-Citizens?

Let us now return to the question of Germany as a country of immigration. We usually formulate the question of the place of foreigners in our polity as follows: "Are foreigners guests or fellow citizens?" In accordance with the prevailing viewpoint, refugees and foreign workers are simply granted the status of guests, a policy which, however, does not apply to ethnic Germans, wherever the country of their birth may be.

Germany as a Refuge

What kind of an immigration country then, is the German Federal Republic? We give the preference to "relatives", that is to say, to members of the family, who even if they did not previously belong to the household, are, nevertheless, members of the ethnic community and of the "fatherland", and are considered to be such, even if they were not born there and have never lived there, as, for example, in the case of descendants of one-time emigrants. These evacuees of German ancestry, coming from the wide expanses and historic depths of eastern Europe belong, therefore, to "us". But the ultimate reason why the West Germans receive these people and grant them all social, political and cultural rights, is not to be sought in an affinity of national and racial

ties, but in an affinity of another kind, that is to say, in an historical relationship which we share only with these Germans. That is the responsibility arising from the violation of basic human rights that was planned and begun during the years of the Third Reich, but, thank goodness, not carried through to the end.

We must face the fact that Germany will continue to be a place of refuge for refugees and poverty-stricken people who certainly are not relatives. With reference to this situation, responsible ministers come forward to proclaim that Germany cannot take in five billion people. This is certainly true. Yet there still remains the question of what our obligation is to needy foreigners. When is the point of our increasing prosperity reached at which poverty-stricken people have the right to insist that they are entitled to a share of our riches? Must they show that there is a causal connection between their poverty and our prosperity? Rather than having this tremendously large immigration, could the problem not be more easily solved by exporting our prosperity? It is clear that the arrival of German immigrants from the East is only an offshoot of the social disparity that obtains between West and East and, still more, between North and South. This is something that we have been aware of for decades, but now that the Cold War has come to an end, we are filled with anxiety.

Open Economically but Politically Restrictive

I am not now speaking of political refugees; it is clear that their plight cannot be mitigated by the export of wealth or development aid, but only by allowing them to settle here. The fact is that freedom can only be shared within a free territory. The

right of asylum should, therefore, take precedence over all considerations regarding quota regulations. It should not for any reason whatsoever be eliminated from the basic law of any German state or European federation. A person who has escaped from persecution should under no circumstances be expelled as long as he has no possibility of going to some other suitable place where he would like to live. It is, of course, true that this principle can be put into practice only if the number of people seeking asylum is not so large that it is no longer possible to examine each individual case with a view to ascertaining whether the application for asylum is justified or not. Unfortunately, this has become virtually impossible in our time with its massive, large-scale migration for political and also ecological reasons.

We come finally to a controversial matter which, for me, is the most important question of all. When foreigners, for legitimate reasons, live in a certain political community, are they not justified in demanding civil rights including participation in political affairs? Should citizenship follow automatically after a residence of some length of time in a certain place, or because this is the birthplace of the person in question? Or, on the contrary, should the regulations regarding naturalization be more strict and exclusive than those regarding immigration, which is the case in Germany? Unlike other nations of western Europe and overseas, we have a legal principle that is deplorably antiquated, the *ius sanguinis*. The consequence is that we treat our foreign workers as children, children of a particular kind. They are children in that they are under our command; and children of a particular kind inasmuch as, unlike other young people, they are not allowed to

grow up and attain maturity. The same situation once obtained in the dim and distant past, in the Athenian polis with its metics and slaves. All work in this otherwise eminently respectable political community was done by people who, generally speaking, were not allowed to become citizens. Their contribution to the material prosperity of Athens was, according to Aristotle, not enough to justify this. In his view, citizenship required a certain "excellence", a quality not possessed by everyone, and certainly not possessed by those who were under the necessity of working. These foreigners in their capacity as workers, simply provided the material pre-condition for the rank of citizen enjoyed by others; and this, one might say, is very much like the situation in Germany today. The regulations regarding the rights of foreigners resident in Germany, inasmuch as they deal only with matters of work and internal security, prevent these foreigners from becoming citizens. These regulations encourage rotation, impose restrictions on the immigration of families and into over-crowded regions, limit the right to benefit from public welfare services and grimly attempt to make the continued residence of these foreigners dependent on a particular line of work. Restrictions are also placed on basic political rights. Foreigners are not permitted to vote; furthermore, the rights of assembly and of participation in political activity are strictly limited. Our relation to the foreign worker is of an exclusively utilitarian nature; from an economic viewpoint, the community is as open and accessible as a whole neighbourhood; but, politically, it is as restrictive as a family.

It is high time, then, to grant foreigners the right to become fully-fledged citizens. Measured against this, the right to vote

on a municipal or local level is a rather faint-hearted and, more or less, symbolic gesture made in consideration of the anomalies of resident aliens regarding such things as water pollution, garbage collection, etc. What these people are concerned about is not cultural self-realization but their exclusion from participatory politics.

Naturalization does not mean Germanization

Unless political integration is to be postponed indefinitely, one cannot help favouring the immediate easing of the requirements for naturalization, which automatically brings with it civil rights including the right to vote. We are, however, still exceedingly reluctant to accept the foreigner as a citizen rather than simply as a credulous newcomer, a wealthy bourgeois upstart, or the latest thing in culture. We are reluctant to accept as a citizen someone who, though not ethnically Germanized, is no longer a whole-hearted Turk, Tamil, or Tatar in a spiritual sense, as is advocated by many of the younger generation, who, nevertheless, are willing to become citizens. If, according to public opinion researchers, naturalization is viewed with disfavour not only by the majority of native Germans, but even by many elderly foreigners themselves, this fact, I say, instead of being viewed negatively, should be seen as a reason for now asking them to take a political step forward. We still remember their great outcry of November 9, 1933. These foreigners who are opposed to naturalization regard it as a kind of compulsory Germanization, a natural misunderstanding which, however, is at the same time a typical cultural phenomenon. This misunderstanding could be overcome if

permitting dual nationality, something that is viewed with disfavour in Europe because of legal technicalities. On the other hand, if we take the idea of a united Europe seriously, it will, in any case, be necessary to develop new ideas about European civil rights.

In the meantime, I should like to make this practical suggestion: The Parliament of a united Germany should establish the legal right of naturalization, customary in

Europe, according to which anyone who was born on German territory, or has lived here for five years could, upon application, become a citizen with all the rights and duties that this entails. By this procedure we could all become citizens, and yet at the same time, remain sufficiently detached from one another, preserving our own culture and individuality.

English translation by Greeley Stahl

Useless Education?

Rainer Dollase, Bielefeld

Not only the practitioner has each and every day a fresh experience of the limits of education. The empirical educational scientist too cannot avoid concern and mild shock about the powerlessness of education. A critical look at the results of educational research shows more solid ignorance than established insight.

In the 60s and 70s the basic conviction of "scientific child rearing" took hold in Germany too, based on an exaggerated milieu theory ("Environment and education are everything" — "You are not born gifted; you become gifted"). The idea was that the upbringing and education of children and adolescents must be successful if it carried out scientifically, in accordance with precepts which have been shown to be good. This conviction is shaken, both by everyday observation and by scientific studies, for example:

- Failures in education may occur when both the environment and education are optimal.
- One and the same education may lead to different results.
- Successes may occur, in spite of bad education and unfavourable influence.
- Different manners of education may lead to the same result.
- Favourable results may occur even

when there are no intentional attempts to influence education.

Testing the Delusion of Feasability in Education

These experiences feed the suspicion that the upbringing, education and socialization of man are evidently somewhat more

Professor Rainer Dollase was born in 1943. 1965 to 1970 studied psychology; 1974 Doctorate at the University of Saarland. 1976 to 1980 Professor for Educational Science, University of Essen; since 1980 Professor of Psychology,

University of Bielefeld. Principle fields of work: empirical educational science, applied developmental psychology, methods of research. Publications, i. a.: *Limits of Education. (Grenzen der Erziehung.)* 1984; *Development and Education — Applied Developmental Psychology for Teachers. (Entwicklung und Erziehung — Angewandte Entwicklungspsychologie für Pädagogen.)* 1985; *Demoscopy in the Concert Hall. (Demoskopie im Konzertsaal.)* (with Rüsenberg, Stollenwerk).

*Prof. Dr. Rainer Dollase, Primelstraße 11,
4803 Steinhagen/Germany*



complex and complicated processes than one thought when simple theories were current ("Education is everything"). The results of numerous longitudinal studies on the long-term effects of educational and environmental influences in childhood and youth must be seen as particularly provocative for the educational delusion of feasibility. A few examples:¹

Research on "invulnerable" children has established that children can develop into able and psychologically stable adults, in spite of unfavourable rearing and environmental influences. The new research area of "invulnerability research" is looking for protective factors which have protected these children from adverse influences.

As early as 1964 Jean MacFarlaine disproved in longitudinal studies the idea that only happy adults come from happy families and only unhappy adults from unhappy families.

The type and manner of the rearing of children seems to have only a slight effect on the adult personality, according to a series of studies.³

The American Meehl has reported that the degree of concordance for schizophrenia in homozygotic twins is only slightly over 50 per cent. This means that if one homozygotic twin is found to be a schizophrenic patient, the other twin is found to be ill in only slightly more than 50 per cent of the cases.⁴ This result is a particularly formidable challenge for proponents of both the environmental theory and of the theory of in-born disposition: they have the same in-born disposition, the same environment and the same upbringing, yet one becomes mentally ill and the other remains healthy.

The so-called "head start" children were part of what was probably the most extensive experiment in preschool edu-

cation of all time. The longitudinal study of these children admittedly showed some advantages for children in the programme in comparison with the untreated control group — but this was really not enough to be enthusiastic about. There were failures in spite of intensive preschool education (31.6 per cent) and successes in spite of the lack of preschool education (46.9 per cent). "Success" means that the child passed through the school without problems. Other criteria, such as the intelligence or personality characteristics of the former "head start" children differentiated less clearly between the experimental and control groups.⁵

- The "parents' fault theory" ascribes life-long influence on the psychological development to the way parents treat their children in early childhood. This theory can now be regarded as weakened. For example, Arlene Skolnick⁶ and H. J. Hemminger⁷ have creditably dealt with and disproved this myth.

- In all studies of the effects of educational or therapeutic measures those cases where the measures proved to be deleterious have been coyly excluded. Adverse effects occur with measures which on average are clearly successful. As early as 1943 Beth Wellmann estimated that this percentage was about 7 to 10 for preschool children, for whom a reduction in intelligence was observed after starting preschool.⁸ Today we know that therapies too can be damaging — even those which were successful with many other patients.⁹

Further studies could be added to the list of those which relativize the importance of upbringing and education. Modern developmental and educational psychology regards man as being much more flexible and elastic than educational determinists have accepted. In a historical

or intercultural comparison it is always surprising under what unfavourable conditions man can still thrive.

Upbringing and Education – Intervention in the Unknown

In view of these results do we need upbringing and education at all? Are upbringing and education not senseless when they produce failures in spite of scientific support? And when on the other hand lack of upbringing or bad upbringing can be successful?

We have well known sedatives ready to treat the internal turmoil which such radical questions produce in us. If a good upbringing fails this is due to disturbing factors, such as television, society, the patriarchy or some such thing. If things go badly at school it must be the fault of the family. The search for those who share responsibility is certainly correct, although the lack of imagination with which always the same culprits are presented is worrying. The fact is that human experience and behaviour are influenced by a multitude of factors which, to make it worse, interact with each other and can evidently produce the most miraculous effects in this way. The maxim for all approaches of experimental science to upbringing and education is "multifactorial genesis" — although this is not always disclosed. There is nothing which cannot be explained or influenced by the complex interaction of a multitude of factors — of which many are presumably still unknown. The model of the multifactorial systemic causation of differences in experience and behaviour in man easily allows not only an assessment of the relative significance of the subgroup of educational factors, but also encourages the deepest scepticism, which leads one to see the oc-

casional success in education or upbringing as the purest miracle.

About 250 articles on "educational psychology" appear every month. Each article offers proofs for the effect of one factor or for the effects of the interaction of factors. It cannot be made more obvious that the events in education are always scientifically underdefined. (Forget for the moment that no practising educator can always have this knowledge at hand.)

There is much that we do not yet know. That each month so much that is new is discovered must lead to this assumption. The complicated network of the factors leads to unintended side-effects, contraindications and interactions, so that it is now as difficult for us to recommend an educational measure as a drug with incalculable and unknown side-effects. Educational teaching and advice must reckon with a relatively high risk of failure or paradoxical effects when they are directed to a process which is very incompletely understood and is always underdefined which means of only partially explained function.

There is no difficulty in a more extended discussion of the problems in the thesis of feasibility in education.¹⁰ A brief summary of the results of the available studies will be given in the form of the following citations from well-known empirical educational scientists. Breznik writes: "In a real case our knowledge is rarely enough for educational measures to be more than interventions in the unknown with unknown results."¹¹ Klauer comes to the identical conclusion: "At the moment we fail here totally: We have no adequate knowledge of the probabilities with which desired or undesired results occur when an educational intervention is carried out. It is actually frightening just to make this clear to oneself..."¹²

cesses and failures can occur with and without, or with false and correct education. Unfortunately or fortunately (depending on the viewpoint) we do not know why. The conviction of the efficacy of education is cultivated in the milieu of popular science, but must be scientifically classified as a virtual or apparent attribution of efficacy; it is mostly made by those who have "success", although in the individual case there is no convincing reason to ascribe this "success" to "education". But it *could* be the case — and we are not in the position of being able to disprove educative determinism conclusively, just as our proof of educational indeterminism was not quite successful.

Educational Rules Are Statements of Probability

There is an illuminating solution for this apparent paradox. It becomes clearer if you refer to a familiar fact. Far from every heavy smoker falls ill with lung cancer — but consistent non-smokers can. It is clearly the case that smoking leads to lung cancer with greater probability than does non-smoking. The generally valid rule or recommendation is however useless for an exact individual prognosis. In educational science we are dealing almost exclusively with a corpus of general rules — it is unimportant if these have been found empirically by experiments or if they come from experience and observation in everyday education. The already cited example of the long-term studies of preschool education make this clear. On the average this is successful and important for slum children, even though more than a third do *not* profit from it. A scientifically based practice for bringing up children in the family is *on the average*

certainly more successful than one that does exactly the opposite. However there will be failures, in spite of the best educational efforts in the family, preschool and school. The collective or global efficacy of the measures recommended cannot then be seen in the individual case or in one's own school class, as the local failure is inherent and typical of average recommendations. Only with a certain probability do educational measures have those effects which they should have on the basis of experience. Our collection of rules is educationally recommended, empirically tested and verified by experience, but is only legitimized "probabilistically" — the single case or the single class can easily fall through this wide-meshed net and can develop quite differently from what was expected.

The merely probabilistic correctness of our activity is frightfully frustrating for the educator. You do something which should be correct and you may have no success. The turning away from the practice of "science" often has this cause. As you do not find the desired effect in your class the rule is condemned wholesale and "science" is rejected as being remote from life. This disappointment is based on a deterministic misunderstanding of probabilistic strategies and is in contrast to the consistent behaviour of other users of probability. For example, psychological sales measures are regarded by managers of chains of retail shops as being worth taking to heart, even if only one in a hundred customers reacts, as that leads to a measurable increase in sales. However, can we as educators behave in this way? For example, should we retain a measure in teaching, although we recognize that only one child reacts as expected to it? Or what should we do as parents of a single child when the arsenal of generally

correct measures for the diminution of school stress does not work?

Before we turn to possible ways of overcoming this unsatisfactory situation, we want to deal with the necessity of humane handling of failure in education or instruction. The idea of the educationally feasible is inhumane because it leads to senseless assignment of blame to the educators. If the education happens not to have worked the educator is subject to the additional suspicion that he has made "mistakes", although he has indeed orientated himself according to the necessary measures, which is not believed. This would be comparable to suspecting a non-smoking lung cancer patient of probably having smoked secretly. It would be more correct emotionally to exonerate those who are failing, to support them and to help them in relieving their frustration. Those who fail in education have lost in what is to some extent a game of lottery – it could have been us.

"Galileic Turning Point"

Now there is no real necessity for a Kismet attitude or for fatalism. The educator should perhaps wear his „optimism with a mourning band”,¹³ but this should not condemn him to inactivity. The limits of education are a challenge, both for science and for the practice, and everywhere people are looking for solutions. For example, one can expect the decisive rise in quality from a "Galileic turning point" in the consolidation of our educational measures. This is not the expression of a vague hope for an as yet unknown breakthrough, but an objectively describable procedure. Within psychological research the "Aristotelian" procedure means the highly typical orientation according to general principles, such as:

"The social class influences the achievement", "Praise increases the motivation", "Authoritarian behaviour from the teacher leads to decreased creativity". In these paradigms the individual case vanishes in a mass of laws – "The frequent is lawful", as Miriam Lewin put it. In practical education the orientation by these general rules must lead to the paradoxes and frustration which we have described above as their efficacy is only probabilistic. "Galileic thinking" starts from the opposite position: "The single case is lawful", i.e. each pupil lives in a unique system of many causes which explain his unique experience and behaviour and which provide the basis for unique measures to alter it. The general rule ("Authoritative behaviour by the teacher leads to decreasing creativity") must not hold for the individual case. In Galileic thinking no help is expected from general rules. In contrast, it is assumed that one must clarify the causes and design the educational measures for the individual case. To fulfill these demands the educator or teacher must have "individual competency" and the freedom to look after each case differently. Educators require competency in the heuristic solution of problems. They are the local "problem solvers" and must behave like researchers studying and having to change a network or system which is still unknown and which functions according to its own rules.

Dealing with Indefiniteness and Complexity

Thus it is maintained that "qualitative individualization" on the basis of Galileic thinking should succeed through the role of the "educator as problem solver" through research of the causes and by means of appropriately designed mea-

ures for the individual case. This sounds like a demanding definition of the roles and one must ask if this can be fulfilled. For example, in the modern psychology of thought successful methods have been established for dealing with "indefiniteness and complexity". The "teacher or educator as problem solver" must also be able to deal with indefiniteness and complexity and with an unknown number of causes and their unknown interactions. In the famous "Lohhausen" experiment on the psychology of thought perception, carried out by a research group lead by the Bamberg Professor of Psychology Dörner, subjects were appointed as "Mayor" of the fictitious town of "Lohhausen", of which the data were stored in a computer. The subjects were laymen in the fields of political and applied economics. This community functioned according to a network of causes and effects, with many mutually interacting factors, and which was unknown to the experimental subjects. After years of regular work as the Mayor of Lohhausen some of the subjects left the fictitious community in a devastated, others in a flourishing state. The good mayors put for example more why questions, retained more information, had orders of priorities, were cognitively more complex and reflective and devised more measures. The bad mayors were i. a. more impulsive and fixated on a single cause. In short, on the basis of this one study it was possible to recognize a series of diagnostic rules and the consequences resulting from attitudes and activities, which promise success in dealing with the complexity and indefiniteness in the scope of qualitative individualization. One can assume that these rules could help in education. But what would be the side-effects of education in which the pupil had to be regarded as the

experimental rabbit of a teacher who doubled as research scientist?

Overcoming the Limits by Systems Theory and the Expert Approach

"Qualitative individualization" is then a sort of educational research on the individual which takes into account the complexity and multifariousness of the educational problems and the causes of behaviour of the individual. On the other hand, the approaches of systems theory regard the educator and educated both as "self-steering". Education is then the interaction between two "autopoietic" systems,¹⁷ each of which functions "self-referentially", according to its own laws. An effect on "he who is to be educated" can be expected when the educator and pupil "possess comparable structures"¹⁸ or when "common consensual areas" are present, which may have to be produced by "structural coupling between educator and pupil".¹⁹ This theoretical treatment sees education as a "common undertaking of educator and educated", a continuous mutual process of regulation and change, which has little to do with traditional education. The autopoietic approach fits the results of modern developmental psychology well, which conceives "individuals as producers of their own development"²⁰, and which provides empirical evidence for effects of the pupil on the educator (for example in "retroactive" socialization).²¹ This approach does not make education easier, but more tedious. You must accept from the start that you cannot achieve everything.

It is always possible for education to succeed – either as the expected result of the application of empirically proved rules with probabilistically guaranteed efficacy, or as the result of the influence of

factors which are not related to education. On the other hand, it is also possible, as in the basic idea of the "expert approach", that good teachers (experts) possess abilities which we do not yet understand and which should be researched. Thus "champion teachers" have been studied when they plan or give instruction and it has been attempted to discover what they do differently from "bad" teachers. The results obtained are interesting rather than banal and encourage the belief that traces of the much evoked teachers' intuition or talent have been discovered. The parallels are evident to the Lohhausen experiment and the good or bad mayors. This research approach is still really new and its results are nevertheless already so complex that their communication to educators should be difficult. Moreover education even from "champion teachers" can fail.

Hindrance: Collective Education

The scientific approaches towards the improvement of the effectiveness of education and to overcoming its present limits all show more or less clearly that they must be combined with more effort or more dedication to the individual. The next qualitative improvement in education is therefore conceivable, but is it feasible? In all industrial countries there is a serious barrier towards improving education. More and more children and adolescents must spend more and more time in public educational institutions. Collective education makes intensive preoccupation with the individual more difficult. Qualitative individualization presupposes that the numerical ratio of educators to educated is similar to that in a family — for instance 1 : 5 or less. This is not an ideal but an obligatory relationship. This teacher

pupil ratio cannot be paid for in the state school system.

The family is falling apart and is losing its educative function. It is disqualified as an agency of qualitative individualization. In his book "The End of Education" ("Das Ende der Erziehung") Giesecke described this loss and redefined the family as a "home port" whose task it is more and more rarely to prepare the children for life. In fact in future we must assume an increase in the demands for care and education outside the family. In the last American presidential election (1988) the "day care crisis" was one of the important questions. The modern neglect of children by the affluent is a neglect of their education and upbringing and is even more striking in the U.S.A. than in our country. The U.S. preschool pedagogue Zigler call for i. a. an extension of afternoon instruction at schools. The crisis in child care in Germany will have to be met by all day schools, afternoon teaching, school social work, creches and by new day nurseries.

This trend to collective education seems now to be irreversible and will turn out to be explosive for the present school and educational system. This is designed for the conditions of the fifties, in which school could concentrate on instruction and teaching, because upbringing occurred after the school.

The well meant suggestion "to run schools on pedagogic principles" is, in the absence of organizational measures, at the wrong address. School and family policies are closely connected and one cannot give the schools the task of making good deficits in upbringing without freeing them from their antiquated position as purveyors of morning instruction. At the moment it is unclear if the school system wishes still to concentrate on its assign-

ments of teaching and instruction or if it wants to take on care and upbringing too — or if parallel institutions such as creches are to substitute for the lost familial upbringing.

However education may be organized in future, the question must always be put, at various degree of urgency, of whether education in groups by professional and paid educators can be as effective as upbringing in the context of a family used to be — also if a scientifically desirable qualitative individualization is at all possible in collective education. New limits will have to be set for educational effort.

The Fleeting Character of the Limits of Education

The limits of education can only be established when educational measures are used to attain a definite goal. The theme "limits of education" is thus subject to the philosophy of the goal-directed rationality of pedagogic activity and so is bound in a logical corset, which can be loosened by argument according to wish, or even removed. Educational goal can be set so low that they can be attained without special measures. The results of education are then retrospectively evaluated as "not bad" or even "actually good". Goal-directed rational education can then simply be denied. He who argues like this is avoiding a painful and existential basic experience by means of semantic juggling — you never get what you want. When the twelve year old no longer wishes to live, when the fourteen year old is a drug addict and when the thirty year old still has not completed a professional training, then this thoroughly academic debate, as to whether education should be an intentional, logically goal-directed process or

not, grows quiet — one rightly asks what education can do to hinder all this.

Apart from this uncandid treatment of the logical scope of the theme, the possibilities are set by the historical facts. How we see successes and failures in education and normality or deviance changes within periods of time and is not historically constant. Thus we could imagine a distant time when the extremely low frustration tolerance of the coming generation, a result of education and environment, is regarded as absolutely normal and not at all a failure — because everyone is like that. Changes in society allow the possibility of adapting to the increasing sensitivity of man — this must not lead to impairment of the functioning of society. The economically motivated competition of the industrial nations for an effective educational system would not have to suffer either after secular changes in the results of education — if the frustration tolerance sinks everywhere then the conditions for competition will not be distorted. If for example the collectivization of education alters the results of education everywhere then the societies will adjust to this and no one will object to the "new men". Our measures are relative, not absolute, and the limits of education are consequently transitory limits.

Translated by R. A. Yeates

¹ Dollase, R.: *Limits of Education. (Grenzen der Erziehung.)* Düsseldorf 1984. Ibid.: *Development and Education — Applied Developmental Psychology for Teachers. (Entwicklung und Erziehung. — Angewandte Entwicklungspsychologie für Pädagogen.)* Stuttgart 1985. — ² MacFarlane, J.: *Perspective on Personality Consistency and Change from the Guidance Study.* Vita Humana 2 (1964). — ³ Mednick, S. A. / Harway, M. / Finello, K. M. (Eds.): *Handbook of Longitudinal Research.* New York 1984. — ⁴ Meehl, P. E.: *Theoretical Risks and Tabular Asterisks: Sir Karl, Sir Ronald, and the Slow Progress of Soft Psychology.* Journal of Consulting and Clinical Psychology.

logy 42 (1978), pp. 806 - 834. — ⁵ Lazar, I.: Lasting Effects of Early Education: a Report from the Consortium for Longitudinal Studies. Monographs of the Society of Research in Child Development, No. 195, 47 (1982) pp. 2 - 3. — ⁶ Skolnick, A.: The Myth of the Vulnerable Child. *Psychology Today*. 1978, pp. 137 - 140. — ⁷ Hemminger, H. J.: Childhood as Fate? (Kindheit als Schicksal?) Hamburg 1982. — ⁸ Wellmann, B. L.: The Effects of Preschool Attendance upon Intellectual Development. In: Barker / Kounin / Wright (Eds.): *Child Behaviour and Development*. New York 1943, pp. 229 - 243. — ⁹ Hemminger, H. J. / Becker, V.: When Therapies Damage. (Wenn Therapien schaden.) Hamburg 1985. — ¹⁰ Cf. Dollase, R.: Ref. 1, 1984. — ¹¹ Brezinka, W.: Limits of Education. (Grenzen der Erziehung.) *Pädagogische Rundschau* 35 (1981) p. 304. — ¹² Klauer, K. J.: On the Necessity, Possibilities and Limits of Empirical Educational Research into the Aims of Teaching. (Über die Notwendigkeit, Möglichkeiten und Grenzen Emp.-Päd. Lehrzielforschung.) In: E. König / P. Zedler (Eds.): *Research in Educational Science: Positions, Perspectives, Problems*. (Erziehungswissenschaftliche Forschung: Positionen, Perspektiven, Probleme.) Munich 1982, p. 145. — ¹³ Prange, K.: Teaching as a Process of Experience. (Pädagogik als Erfahrungsprozeß.) Vol. 1 The Pedagogical History of the Experience. (Der Pädagogische Aufbau der Erfahrung.) 1978. Vol. 2: The Epoch of the Experience. (Die Epoche der Erfahrung.) 1979. Vol. 3: The Pathology of

the Experience. (Die Pathologie der Erfahrung) 1981. Stuttgart. — ¹⁴ Lewin, M.: *Understanding Psychological Research*. New York 1979. — ¹⁵ Jürgens, B. R. / Harootunian, B.: Teaching as Problem Solving. *Journal of Teacher Education* 15 (1964) pp. 420 - 427. Gage, N. L. (Ed.): *Teaching as Clinical Information Processing*. NIE Conference on Studies in Teaching, Panel 6. Washington D. C. 1973. — ¹⁶ Dörner, D. / Kreuzig, H. W. / Reither, F. / Städeli, (Eds.): *Lohhausen. On Dealing with Indefiniteness and Complexity*. (Lohhausen. Vom Umgang mit Unbestimmtheit und Komplexität.) Bern 1983. — ¹⁷ Maturana, H. R.: Recognition: the Organization and Embodiment of Reality. (Erkennen: Die Organisation und Verkörperung von Wirklichkeit.) Bruck 1985. — ¹⁸ Jürgens, B.: Goals in Education and Regulating the Activity of Teachers. (Erziehungsziele und die Regulation des Handelns von Pädagogen.) Bamberg University. Faculty for Education, Philosophy and Psychology, 1988, p. 335. — ¹⁹ Jürgens, B. (Ref. 18), p. 327 ff. — ²⁰ Lerner, R. M. / Busch-Hannagel, N. A. (Eds.): *Individuals as Producers of Their Development*. New York i. a. 1981. — ²¹ Kleine, J.: Retroactive Socialization. (Retroaktive Sozialisation.) Weinheim 1983. — ²² Bromme, R.: The Teacher as Expert — Design of a Research Approach. (Der Lehrer als Experte — Entwurf eines Forschungsansatzes.) In: H. Neber (Ed.): *Applied Psychology in the Solution of Problems*. (Angewandte Problemlösepsychologie.) Münster 1987, pp. 127 - 151.

Money and Magic

The Economic Background of Goethe's "Faust"

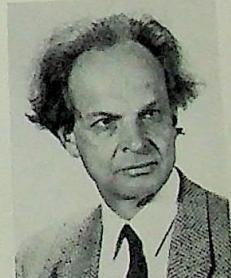
Hans Christoph Binswanger, St. Gallen/Switzerland

Goethe's "Faust" is widely recognized as one of the great works of our cultural heritage; but it is, at the same time, something more than this. "Faust" is also a profoundly modern work in its implications. The fact is that the second part of the drama is concerned with a theme that has become the central preoccupation of mankind today, that is to say, the growth and development of the economy. This, since the Industrial Revolution, is the phenomenon that, to an ever increasing extent, has drawn all other aspects of life into its vortex.

Goethe, in his capacity as Minister at the court of Weimar, was in charge of questions of the economy, for which he had a particular responsibility. He was, therefore, very well qualified to discuss such matters, all the more so as, throughout his life, he had concerned himself very intensively with the literature of economics.¹ He saw very clearly that the fate of mankind would be primarily determined by economic developments. This is shown in the second part of the "Faust" drama. Faust is the "new man", who no longer looks to the hereafter for the culmination of his life, but finds it rather in the progress to be made in the modern secular world. He, therefore, shakes off the trammels of tradition and of a narrow belief.

If Goethe was able to depict so clearly the "Faustian" way followed by mankind today, this was because he had a knowledge and understanding of the historical developments that led in this direction. Following a brief résumé of the contents of the "Faust" drama, the present article will concern itself with these developments as shown therein.

Professor Hans Christoph Binswanger was born in Zurich in 1929. Following university study in Zurich and Kiel, he received his "habilitation" in 1967. Since 1968 he has been professor of economics at the university of St. Gallen. In his academic



career Professor Binswanger has particularly concentrated on questions of money and credit, the environment, and the history of economic theory. Among his publications the following may be mentioned: *Wege aus der Wohlstandsfalle* (in collaboration with W. Geissberger and T. Ginsburg), Frankfurt 1978; *Arbeit ohne Umweltzerstörung* (in collaboration with H. Frisch and H. Nutzinger), Frankfurt 1983, revised edition 1988; *Geld und Magie*, Stuttgart 1985; *Geld und Natur*, Stuttgart 1991.

Prof. Dr. H. Ch. Binswanger, Guisanstraße 5,
CH-9010 St. Gallen / Switzerland

The Pact with the Devil

The Faust story tells about a pact with the devil. According to popular legend, Mephistopheles, the devil, is to serve Faust in this present life on earth; but in the hereafter, on the contrary, Faust is to be subject to the devil. In Goethe's version, different in this respect from the popular legend, the *quid pro quo* of Faust depends on a wager. Faust's obligation to render return services holds only if Mephistopheles can provide him with consummate happiness, with a "highest moment" such that he would desire to hold it forever fast. Behind the wager between Faust and Mephistopheles there is in the "Prologue in Heaven" the wager between God and the devil, involving the question whether the latter can lead Faust astray from the right way "as long as he on earth shall live". The pawn of this wager is the soul of Faust.

The first part of the "Faust" drama, the Gretchen tragedy, shows the attempt of Mephistopheles to make the enjoyment of love the culminating point of Faust's aspirations. But the attempt fails; it ends with the execution of Gretchen and the flight of Faust. Mephistopheles then changes his plan. He now proposes to lead Faust to the supreme moment by means of economic success. This attempt, depicted in the second part of the "Faust" drama, succeeds. With the aid of Mephistopheles, Faust dams up a barren coastal strip, and then prepares for the colonization and cultivation of this newly reclaimed land. In his vision of the future colonization of this territory, Faust, as he himself acknowledges, experiences the "highest moment".

Faust's Plan

By what means do Mephistopheles and

Faust succeed in achieving this ambitious goal? Faust, supported by Mephistopheles, first comes forward as the Emperor's counsellor in financial questions. He shows the Emperor how he can get rid of his debts by paper money. When Faust returns from Greece, where he had gone in quest of Helena, he catches sight of the coastal strip that he wants to dam up and transform into fertile soil. He has a vision of newly reclaimed land, and of a new economic order that he himself will create and shape through the control of natural forces.

When Faust and Mephistopheles once again come to the aid of the Emperor and, with the help of the "three wild fellows", Raufebold, Habebald, and Haltefest, put down an uprising against him, the Emperor, in thanking for this support, reciprocates by ceding the land on the coast to Faust, whose property it now becomes. By means of large-scale operations involving the labour of many workers and much expenditure of energy, Faust is able to drain this virgin territory and to make it fertile. In so doing, he masters the forces of nature by means of technology.

But first there is a problem with the old married couple, Philemon and Baucis. Unwilling to give up their home on the dunes after so many years, and distrusting these new achievements, they offer passive resistance to these projects of colonization. They are compelled to leave their home, and die in the process of evacuation. Shortly before the completion of the great work Faust goes blind, but the vision of success is enough to make him say that he has now achieved the goal of his wishes. Beyond this point nothing further is to be envisaged. Faust dies.

The Three Elements of the Faustian Plan

In the "Faust" drama, Goethe shows us three elements of the "Faustian plan", that is to say, of the economy of the modern world, of which the beginnings were already perceptible in his time, and which have subsequently developed and demonstrated their full effectiveness. We are aware of their effects, but are today often oblivious of their origin. They are shown by Goethe as follows:

1. The creation of paper money
2. The new right of ownership (ownership as "dominium")
3. The utilization of mechanical energy

By constructing his plan on the foundation of these elements, Faust succeeds in making himself the lord over nature and in establishing the realm of a modern economy.

The Creation of Paper Money

The beginning is made with the creation of paper money and the multiplication of money. Early on in the literature about Goethe's "Faust" it was pointed out that the model for the experiment that Faust and Mephistopheles set up in the imperial court (in the first act of the second part of "Faust") was to be found in the famous and infamous system of John Law at the beginning of the 18th century. The matter in question is the issuance of printed paper money as a substitute for gold coins. When the chancellor proclaims

*Zu wissen sei es jedem, der's begeht:
der Zettel hier ist tausend Kronen wert.*

*To all to whom this cometh, be it known:
A thousand crowns in worth this note
doth own.*

one then naturally thinks of the Scotsman, John Law, displaying a piece of paper, a banknote of this kind from the "Banque Royale", of which he was the founder. It was Law who in the year 1717 with the aid of this bank helped the heavily indebted French State under the regency of the Duke of Orléans to get rid of its heavy burden of debt. Instead of debt the citizens received banknotes, with which they could buy not only all manner of goods, but also shares of stock in the newly founded enterprises for commerce and trade, which increased in value as more and more such banknotes were issued and used for the purchase of these shares. Commercial and social life flourished. The city of New Orleans in the new world of the West and the city of Lorient in the old world came into being. There was a vigorous development of shipping traffic and trade between these cities, between America and Europe, which was the basis of this new prosperity.

But John Law forced the pace of this experiment with paper money unduly. The consequence was a general inflation, and, above all, an inflation of share prices, which, despite rising nominal profits, resulted in a drastic decline in net yields. Speculation now turned in the contrary direction. There was a general selling of shares, and finally, the whole system that John Law had built up collapsed.

This experiment lasted three and a half years. Then it came to an end. This, however, did not mean the end of the attempt to increase the supply of money by means of paper money. By concentrating on the system of John Law and its collapse, one can easily forget an earlier experiment in the creation of paper money, namely, that of the Bank of England, founded in 1694, which began to issue banknotes as far

back as 1696. This policy, supported by the City of London, has survived all the storms that even the Bank of England has been compelled to endure. The English experiment has now lasted 300 years, and has spread all over the world. It is the basis of the world currency system of today, which, besides the paper currency of the issuing banks, also includes the private bank money of commercial banks and the central bank money of the International Monetary Fund. Thanks to this system, world trade from its modest beginnings in the early modern world has been able to develop to the almost incomprehensible dimensions of the world economy today.

Of crucial importance in this connection is the fact that the Bank of England was not a State institution, but a commercial bank, which, thanks to the privilege of issuing paper money which the State granted to it, was, in turn, able to grant credit to the State. (The English State also had financial difficulties!) Otherwise the bank worked for its own account, and granted credits for trade and investment. It was not until later that this system was expanded by the founding of commercial banks, which then took over the function of granting credit for trade and investment.

Faust, Mephistopheles & Co.

Hardly anyone has ever taken notice of the fact that Goethe conceives the issuance of paper money at the imperial court in very much the same way. Here, too, what we see is the creation of a private bank. And this bank might very well have been called "Faust, Mephistopheles and Co".

When the success of the experiment with paper money is assured, the Empe-

ror speaks to Faust and Mephistopheles as follows:

Das hohe Wohl verdankt euch unser Reich;

Womöglich sei der Lohn dem Dienste gleich.

Vertraut sei euch des Reiches innerer Boden.

*Ihr seid der Schätze würdigste Kustoden.
Ihr kennt den weiten, wohlverwahrten Hort,*

Und wenn man gräbt, so sei's auf euer Wort.

*You've given our empire this prosperity;
The pay, then, equal to the service be!
The soil intrusted to your keeping, shall you*

*The best custodians be, to guard its value.
You know the hoards, well-kept, of all the land,
And when men dig, 'tis you must give command.*

What this means is that an issuing bank is to be created, and that this bank will issue paper money on its own account. On the other hand, it is true that the value of this paper money is secured by the treasures of gold in the ground, and which belong to the State. Of course, the word "graben" (literally meaning *dig*) is here used in a figurative sense to signify nothing less than all activities which lead to the issue of bank notes, including above all, the granting of credits. In this the reward is to equal the services rendered, which means that the State and the bank will divide the profits equally.

From Forced Labour to a Free Democratic Society

It is not necessary to explain why the

State needs money; the State must pay off its debts. But why do Faust and Mephistopheles need money? The answer to this question is to be sought in the later transformation of the barren coastal strip into fertile new land at the end of the drama. Faust gives Mephistopheles the command to pay. But what does he pay with? Certainly not with gold coins. Where could he get them? He pays with the paper money of his own bank!

It is for Mephistopheles to pay out the wages to the workers, whom Faust addresses as "serfs". He is the entrepreneur who alone commands, among other reasons, because of the money at his disposal. Faust maintains that "one mind suffices for a thousand hands". (*Genügt ein Geist für tausend Hände*). It is true that he also speaks of the multitude that toils for him. Besides the work that is done for wages, there is also forced labour. Here we see the early stage of capitalism, already profiting from new financial sources, and in which state property — in this case a strip of coastland — is offered for economic exploitation. But this early stage of capitalism, which carries out new projects, has not yet broken away from feudalism altogether.

But Goethe goes beyond this picture of early capitalism. Faust already visualizes a free people on free ground, a free democratic society, perhaps even with a voice in discussions and decisions. According to this vision, the population will increase and the gross national product will grow. The hard labour and effort is only at the beginning of this process. Later everything will become more comfortable and agreeable.

*Grün das Gefilde, fruchtbar; Mensch und Herde
Sogleich behaglich auf der neuesten Erde.*

Green, fertile fields, where men and herds go forth

At once, with comfort, on the newest Earth.

That is Faust's conception. The future will be a happier time.

Laßt glücklich schauen, was ich kühn ersann.

Make grandly visible my daring plan.

Since the completion of Goethe's great drama, more than 150 years have elapsed. Faust's vision for the future has now become the reality of our time. The achievements which Goethe clearly foresaw have now resulted from all the efforts and exertions of the first 150 years of the Industrial Revolution with all its attendant crises and misery.

Faust knows — and that is important for the success of the whole undertaking — that he can rely on the help of nature and of natural powers. The exploitation of the workers will not last. Philemon, observing the embanked stream of water, states this clearly:

*Kluger Herren kühne Knechte
Gruben Gräben, dämmten ein,
Schmälerten des Meeres Rechte,
Herrn an seiner Statt zu sein.*

*Wise lords set their serfs in motion,
Dikes upraised and ditches led,
Minishing the rights of Ocean,
Lords to be in Ocean's stead.*

The two — the entrepreneur and the workers — are together lords over nature. This command over nature makes it worth while and profitable to pay the workers. Moreover, in the last analysis,

the workers approve of the paid work, and, to some extent, even of the forced labour. They all expect to reap advantages in the end.

However, in order to achieve this command over nature and natural powers together with the advantages resulting from this, two other conditions besides the creation of paper currency are necessary. In "Faust" Goethe shows us both of them.

Property as command over nature

The first condition is the institutionalization of an absolute right of ownership entirely subject to the economic will. This is the conception of ownership of the Napoleonic Code. Article 544 of this code says: "Ownership is the right to use and dispose of things in the most absolute sense". ("La propriété est le droit de jouir et de disposer des choses de la manière la plus absolue".)

The Napoleonic Code subsequently became the model for civil law throughout the world. This new right of ownership is fundamentally different from previous conceptions of ownership that were based on the idea of *patrimonium*, that is to say, the duty to preserve and cultivate one's inheritance. The word *patrimonium* is derived from *pater* (father) and refers to something inherited. Property is something that one has inherited but which one must bequeath to one's children, in other words, something that the present owner may use but must not use up.

In contrast to this, the origin of the modern concept of ownership is to be found in the concept of *dominium* in Roman law, which is derived from *dominus* (lord), and which guarantees to the person who is the owner at any given time the absolute power to do what he

will with his property, as this is stated in Article 544 of the Napoleonic Code. This is precisely what Faust proclaims, when in the style of an ultimatum, he says to Mephistopheles,

*Herrschaft gewinn ich, Eigentum!
Power and Property to win, inspires
my thought!*

That does not mean dominion and ownership as two distinct things, but rather their fusion in the sense of *dominium*, that is to say, in the sense of an absolute right of ownership, in short, the right of ownership that became the basis of the whole economic development of the 19th and 20th centuries.

Energy instead of work

Another element involved that is still to be considered is the technical foundation of this development. This is to be seen above all, in the use of energy both as substitute for and a supplement to labour. Baucis, who carefully observes the development of the new economy, expressly calls attention to the importance of energy in the creation of the new stream of water:

*Tags umsonst die Knechte lärmten,
Hack und Schaufel, Schlag um Schlag;*

*Wo die Flämmchen nächtig schwärmen,
Stand ein Damm am anderen Tag.*

*Meerab flossen Feuergluten,
Morgens war es ein Kanal.*

*Knaves in vain by day were storming,
Plying pick and spade alike;
Where the fires at night were swarming,
Stood, the following day, a dike.*

Lines of torches, on the morrow,
Were canals that seaward lead.

This picture reminds one of the letter that Duke Karl August sent to his minister Goethe about his journey to England. The letter contains the following remarks:

"England is a veritable paradise of the science of mechanics. A few miles from Birmingham Mr. Watt brought me to coalmines and grounds with iron ore, near which there were factories, hammers and wire-works. Here the hearths of, say, 250 blast furnaces were burning, all of them belonging to a mining company. As a number of such companies were there, alongside one another, I do not believe that it would be going too far to suppose that I saw more than a thousand such smoking, fire-spitting mouths".

It is, of course, true that today, with our use of oil and electricity, coal no longer has the same importance as a source of energy. The important fact is that, at the beginning of the 19th century, Goethe already foresaw that different forms of energy would completely transform life and economic developments.

However, the new technological achievements do bring with them "natural" risks. Mephistopheles utters the following threatening words:

*Die Elemente sind mit uns verbunden,
Und auf Vernichtung läuft's hinaus.*

*The elements with us are banded,
And ruin is the certain fate.*

By "the elements" is meant the forces of nature, and "with us" refers to the powers of the underworld.

Goethe's farsightedness

Only today can we begin to properly appreciate Goethe's far-sighted vision. Not only does he show (in the figure of Faust) the significance of free enterprise aiming at the increase of wealth, which definitely supplants the previous form of economy (represented by Philemon and Bauccis); he also sees that economic progress will give rise to the social problem (seen in the contrast between lord and serfs). Above all, he makes it clear that this will be only a temporary, passing phase of development, inasmuch as this economic achievement results, in the last analysis, from taking possession of nature and exploiting it. In other words, the achievement is based on the transformation of natural resources into monetary value. The social question will, in due course, lose its urgency ("on free soil a people free"); but, on the other hand, the ecological risks (the elements represented by Mephistopheles) will constantly increase.²

¹ Mabl, B.: "Goethes Ökonomisches Wissen". Frankfurt/Bern 1982. — ² Binswanger, H. Ch.: Geld und Magie — Deutung und Kritik der modernen Wirtschaft anhand von Goethes Faust. Stuttgart 1985.

English translation by Greeley Stahl including quotations from the classical translation of Goethe's "Faust" by Bayard Taylor.

Spatial and Temporal Environment

The Chrono-ecology of Biological Rhythms

Till Roenneberg, Munich

In the course of evolution, incidental changes in the genetic material are selected by environmental pressure. The environment has not only spatial, but also temporal characteristics which are mainly determined by the systematic changes within the day or the year. From these "time-spaces" similar requirements and expansion potentials result as from spatial structures (land or water, desert or marshland, etc.). Since adaptation to time-spaces is also an ecological problem, there is not only an ecology of space, but also one of time (chrono-ecology).

Ecological concepts such as niche, environment, or biotope are also applicable in a broader sense in chrono-ecology. However, the requirements of time spaces and their "chronotopes" (e. g., light and darkness) are fundamentally different from those of biotopes. Whereas most organisms adapt completely to a biotope without normally leaving it, they are constantly exposed to the sequence of different chronotopes.

The taxonomies of the animal and plant kingdoms have been closely studied in the last 150 years. The factor time, however, has only been considered in these taxonomies as a necessary prerequisite of change. The ecological aspect of a time space has not been taken into account.

Organisms go through a constant change of dynamic states: activity and rest, energy intake and processing, development and reproduction, cell growth and division, and much more.

A chrono-ecological specialization concerns the temporal compartmentalization and sequence of such states. This is most evident in the temporal compartmentalization of species-specific activity times within the 24-hour time space. There are organisms which are active during the day, at night, or in twilight and

Dr. Till Roenneberg was born in Munich in 1953. He studied biology in Munich and London and was post-doctoral fellow and research associate at Harvard University from 1985 to 1988.

Since 1988 he has been a scientific assistant at the Faculty of Medicine of the Ludwig Maximilian University of Munich as well as a regular guest scientist at Harvard. Numerous publications on the subjects annual and diurnal rhythm in man and the mechanisms of the cellular clock.

Dr. Till Roenneberg, Goethestraße 31,
DW-8000 Munich 2



others that divide their activity into episodes within 24 hours. The activity time of different fish species can be found in all chronotopes, while amphibians are mainly active during the night. Most land-based reptiles are diurnally active, due to the limiting effects of nocturnal temperatures (with the exception of the desert).

Amongst mammals some are diurnal (e.g., man, many hoofed animals, various monkey and squirrel species) and others nocturnal (e.g., mice, rats, and most predators). Among birds, only few species are nocturnal, while the activity of insects and other arthropods can be found in all chronotopes (nocturnal and diurnal lepidoptera, flies and gnats, crabs, scorpions, etc.). A diagrammatic example of a chronotope-related evolution (considering only birds and mammals) is shown in figure 1. The evolution of mammalian activity (gradual shift from day-active to night-active) is closely related to the development of an efficacious thermo-

regulation. Hence, changes of chronotopes are analogous to changes of biotopes: the change from ground to the air was necessarily accompanied by the development of flight mechanisms, the change from day to night by the development of thermoregulation. The change from diurnal to nocturnal activity offered selection advantages for predators as well as prey; the prey were better protected from diurnal reptile predators when their motility was limited due to the low temperatures at night. The same factor also facilitated small nocturnally active predators to catch their sluggish prey.

The example of mammalian and bird evolution exemplifies the equal importance of living space and time space. The evolution of mammals is associated with a change of chronotope, the evolution of birds with a change of biotope. A change of space (be it spatial or temporal) occurred repeatedly in the course of phylogenetic development; however, chrono-

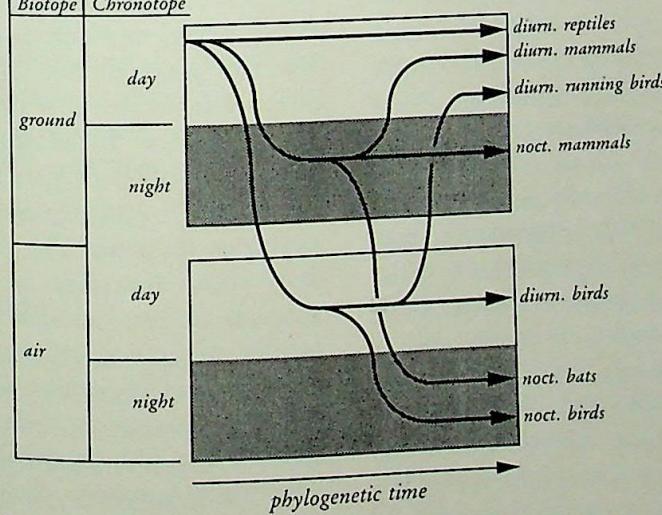


Fig. 1: In the course of evolution organisms can change their spatial environment (here exemplified with ground and air) as well as the temporal niche in which they are active.

and biotopes appear to have never been changed "simultaneously." Via the "detour" of the night, diurnally active mammals evolved secondarily; after the air was conquered by diurnal species, nocturnal birds evolved, as well. With flightless birds (e. g., ostrich or penguin), animals evolved that no longer used the air space, which in turn has secondarily been conquered by mammals (e. g., bats and flying squirrels). Changes and reversals of this kind are known from the spatial phylogenesis. Some terrestrial mammals which, after all, had evolved from marine mammals, later reverted to the aquatic environment (e. g., dolphins).

The change of time space, like the change of living space involves an adaptation of the sensory system: for nocturnal organisms, olfactory signals are of prime importance; for diurnal animals, vision is predominant. Appearance changes, too: most nocturnal organisms are black and white, diurnal animals are either brightly coloured or camouflaged with the colours of their environment.

Just as the activity of the various animal species is distributed in the time space of a day, various functions within the organism have a strict temporal order. On the basis of this functional order within repeating time spaces, biological rhythms evolved. In the case of man, more than 100 different daily rhythms have been described: temperature, hormones, electrolytes, psychological variables, allergic reactions, statistical birth and death frequencies, to name only a few. The maxima of these rhythms are distributed over the entire day. Most of them are more or less related to the alternation of activity and rest (or sleep). This is mainly due to an activity-dependent energy consumption, but the advantage of placing renewal and growth processes

into the rest or sleep phase may also play an important role.¹ However, the evolution of temporal structure and compartmentalization of biological processes is not only related to the influences of the day or the year, but can also be based upon the mutual influence of species. Years of records of trapped lynx in Canada show a ten-year cycle² based on predator-prey interactions. Predator-prey relationships can even lead to a temporal game of hide-and-seek: certain cicada species live as nymphs for many years before developing into reproductive adults for a few weeks. In these life cycles, periods of 13 or 17 years have developed in the course of evolution. Presumably the insects use these prime numbers to "evade" natural enemies whose own development time is shorter. Even with multiples of their generation time, these predators could not synchronize with the emerging episodes of the cicadas.³ Thus, the ecological distribution of species is not only related to the spatial environment, but also shows a systematic distribution in the time space. The example of the cicadas shows that a temporal order in biology is not only a consequence of selection pressure, but also constitutes a selective force for other organisms. In the physiology of multicellular organisms, similar principles of spatial (cell organelles, organs) and temporal order and dependencies apply. The various systemic and cellular functions are either closely coupled to one another (e. g., by the further processing of biochemical products) or run in parallel with a common goal (e. g., reactions leading to cell division). Depending on the imminent situation, many functions can be initiated in addition to the daily routine, but they must be "compatible" with the temporal state of the system (e. g., flight reactions).

Endogenous Rhythms

Just as an internal image of the spatial environment is necessary for orientation, an internal presentation of time seems to have selection advantages for the orientation in time spaces. This task is performed by endogenous clocks which are the internal pacemakers for biological rhythms. The most outstanding characteristic of these endogenous rhythms is that they continue to oscillate under constant conditions (e.g., without light or temperature fluctuations). Endogenous rhythms are governed by a self-sustained clock-work (oscillator) which is not dependent on changes in the environment to produce the internal rhythm. The length of the period of endogenous clocks can deviate under constant laboratory conditions from the rhythmic environment (24 hours or 365 days), but it always remains within its time range. Halberg⁴ has therefore suggested the term "circa-dian" (about one day) for the endogenous diurnal clock. Today, the prefix *circa* is also applied to other rhythms for which an endogenous oscillator is assumed (e.g., annual and tidal rhythms). Circa clocks have thus far been shown to exist for the external representation of the year (circannual),⁵ lunar (circa-lunar) and tidal cycles (circa-tidal)⁶ and that of the day (circa-dian).⁷

Annual Rhythms

According to latitude, the year is characterized by more or less pronounced periodic environmental conditions which are reflected in the biology of almost all creatures. In this respect, the seasonal order of reproduction is particularly noticeable. Blossoming, mating and parental care are so regular in time that for us they vir-

tually take on the significance of a calendar. Equally seasonal are the falling of leaves, molting of feathers, fur, and antlers, hibernation and bird migration.⁸ Many of these annual rhythms continue to function under constant laboratory conditions. Therefore, there must be a "circa-annual" clock responsible for them. The most important environmental factors which influence annual rhythms (synchronize the endogenous rhythm with the external one) are photoperiod (length of day) and temperature.

Humans have also pronounced annual rhythms. Our eating habits (e.g., relative amounts of protein or carbohydrates),⁹ sleep,¹⁰ sexual¹⁰ and reading behaviour,¹¹ our subjective, psychological, and bodily wellbeing,¹² apart from many other factors, are strongly dependent on the season. Based on statistics gathered worldwide, it has been demonstrated that although monthly birth rates can be influenced by a number of social factors (e.g., the "Christmas peak" in the bottom graph of figure 2), the annual rhythm within these statistics is based on biological mechanisms.¹³ Similarly, the monthly rates of suicide and general mortality display an annual rhythm¹⁴ (figure 2).

The rhythm in birth rates is a consequence of a rhythm of successful conception. In Germany the most children are born in February and March and were thus conceived in May or June of the previous year. These rhythms are specific for the geographic location and climatic conditions of a country and are shifted by six months across the global hemispheres.

The annual rhythm in general mortality appears to be mainly influenced by temperature (figure 2, top panel), whereas the annual fluctuations in suicide rates are more closely correlated to the sun (photoperiod, amount of light) (figure 2, middle

panel). Particularly many people die, depending on the country, at the annual temperature minima and/or maxima. The most suicides are not committed in November and December, as is generally believed in the Northern Hemisphere, but occur worldwide around the summer solstice.

The annual conception rhythm is influenced by photoperiod as well as local temperatures (figure 2, bottom panel). Successful conception is particularly high worldwide if the temperatures fluctuate between 12 °C (morning) and 20 °C (noon) (grey areas in figure 2). The greatest increase in conception rates is found

to be around the spring equinox (March 21 in the Northern Hemisphere), when the photoperiod also increases the fastest. At the Equator, the photoperiod is constant throughout the year, but the low annual temperature fluctuations seem to be sufficient as an environmental signal; thus, in these regions conceptions increase around the annual temperature minimum, which in the hot countries most closely approximates the temperature optimum cited above. In most countries, the conception rhythm has shifted its phase (e.g., month of maximum) over the last 50 years, and in addition, has levelled off. Due to working increasingly

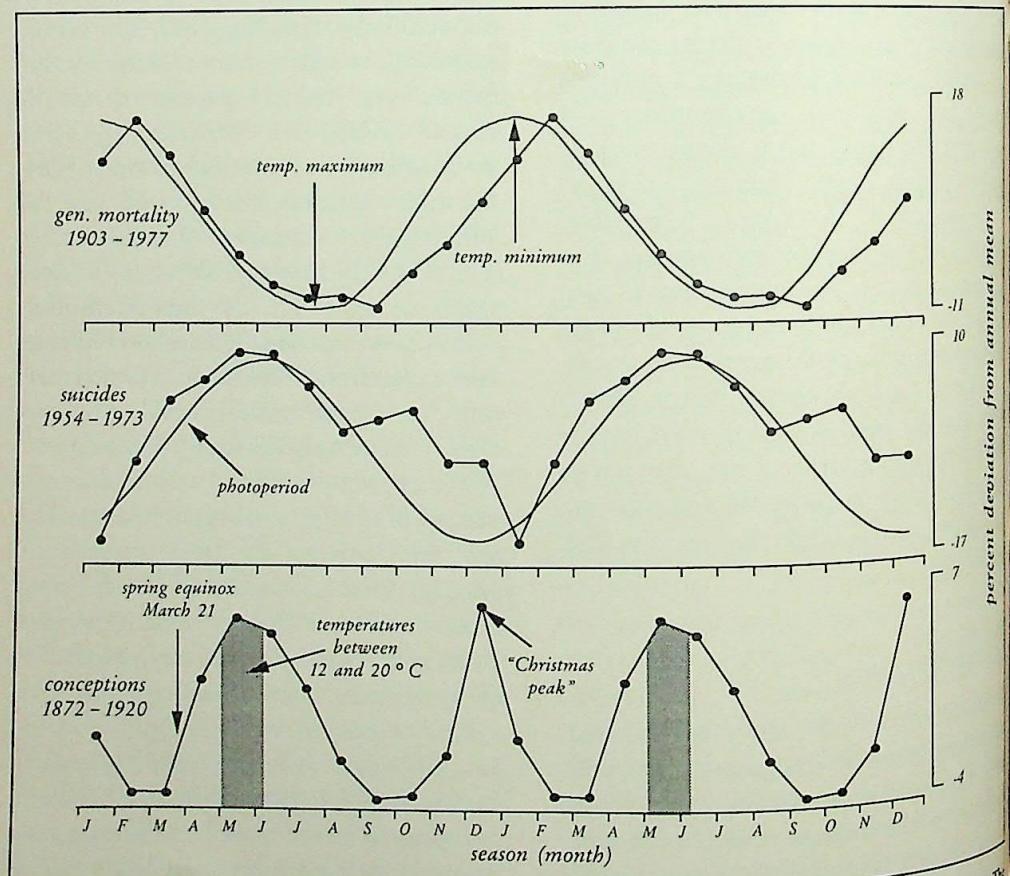


Fig. 2: One way to find annual rhythms in man is by using statistics, here exemplified by monthly rates in Germany. The annual deviations in general mortality are predominantly dependent on local temperature, suicides on photoperiod and births (or rather conceptions) on both these environmental factors. Their greatest increase is worldwide at the spring equinox, and they reach a maximum when daytime temperatures fluctuate between 12 °C and 20 °C (grey areas).

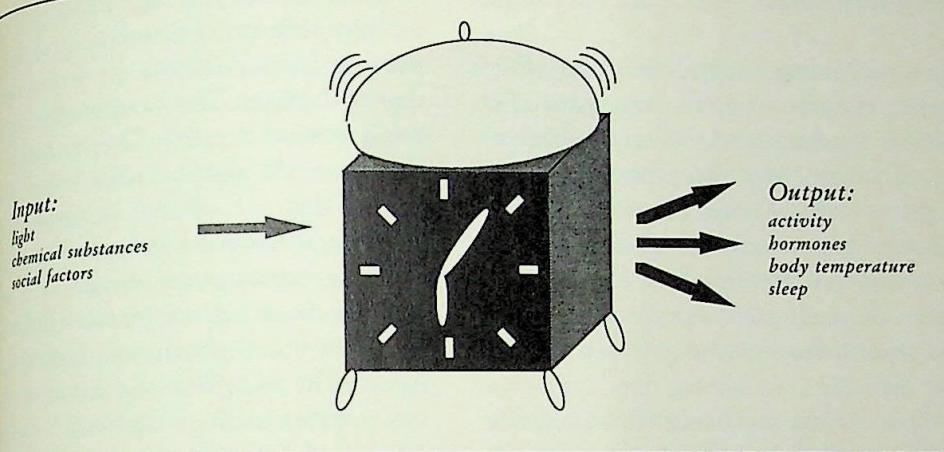


Fig. 3: The mechanisms which produce the 24-hour rhythm on the cellular and molecular level are still unknown; the internal clockwork is thus still a "black box."

indoors, we shield ourselves from the differences in photoperiod or daily amount of light, and we compensate seasonal temperature differences more and more efficiently by central heating and air-conditioning.

In its dependence on photoperiod and temperature, human annual rhythms are comparable to those of animals, whose seasonality is also mainly influenced by these two environmental factors.

Relationships between Temporal and Spatial Environment

The spatial biotope an organism has adapted to can also influence the development of endogenous temporal systems. This is particularly noticeable in organisms which live in tidal zones and are thus exposed to marked environmental fluctuations depending on lunar (29.5 days) and tidal cycles (12.5 hours). For many beach creatures, circa-tidal clocks have been found (period length approx. 12.5 hours)¹⁷ which enable these animals to anticipate the strong fluctuations in their environment. Certain insect species which live as larvae in the water and as

adult animals on land must hatch at particularly low tides. Extreme tidal differences are influenced by the sun as well as the moon. The gnat Clunio can precisely calculate the moment of the lowest tides (approx. every two weeks) in advance by using a complicated internal clock mechanism.

Other, generally nocturnal animals display lunar rhythms.¹⁸ It may be assumed that the activity of most crepuscular and nocturnal animals is influenced by moonlight.¹⁷ Few of these lunar rhythms could be verified under constant laboratory conditions. The ant lion (Myrmeleon) digs little sand craters to catch ants; their diameter shows a circa-lunar rhythm.

The menstrual cycle of women is also repeatedly associated with the lunar cycle, because of its similar period length. Recent studies have shown that there is, indeed, a correlation between the two rhythms but only in few women. However, a biologically relevant correlation between menstrual cycle and the lunar phases, such as that between body temperature and the daily path of the sun, does not exist.

Daily Rhythms

An endogenous daily clock has been found to exist in most organisms. Far more is known about the mechanisms of the circadian clock than about other endogenous circa-clocks. The self-sustained nature of the circadian clock is familiar to all who travel through time zones by airplane. The endogenous rhythm needs several days before we feel "normal" in the new time.

However, the mechanisms of the clock-work (oscillator) itself has thus far not been decoded for a single circadian system. But we do know a lot about the oscillator's reactions to incoming stimuli and its "effect" on the output variables depending on it ("hands"). They are shown schematically in figure 3.

Under constant laboratory conditions, the rhythm of the endogenous oscillator can be observed and recorded for varying experimental time spans, depending on the organism. These "free-running" clocks are more or less precise. For example, the activity rhythm of the squirrel monkey was registered over a period of three years; during this time it displayed a deviation of not more than two percent of the average period (24.8 hours).²⁰

Every rhythm can be described by its period and amplitude as well as by its phase position as compared to other time systems (e. g., local time of day). One of the most important signals for the circadian clock is light. For example, the phase of the internal clock can be shifted by a single light pulse. This shift mechanism is responsible for the ability of the internal clock to be synchronized (entrained) with a so-called "Zeitgeber" (time giver). In nature, the most important "Zeitgeber" is the daily alteration of light and darkness.

Under natural conditions, the organism receives information not only about the intensity, but also the spectral composition of daylight. The latter changes during the course of the day. The spectral information could also be used by the circadian system of diurnal organisms. This hypothesis has been strengthened by preliminary experimental results. The circadian clock of Canaries reacts differently to red or blue light than it does to white light.²¹ The fact, that the circadian clock can differentiate between different colours of light, was first shown unequivocally in algae.²² Exact knowledge of the effect of various colours of light on the circadian clock is also of particular interest to man. With this knowledge, the difficulties of night-shift workers and pilots could be alleviated by using suitable lighting. Airplanes could for example be lighted differently on west-bound flights than on eastbound ones. Night-shift workers could use special eyeglasses to prevent their internal clock from receiving false stimuli from sunlight on their way home. A more profound knowledge about the effects of light on the circadian clock could also be significant for treating certain psychiatric phenomena: for example, seasonal depressions (SAD) have recently been successfully treated by phototherapy.²³ This is probably effective via the patients' circadian system. These phototherapeutic methods could be made even more effective if the spectral sensitivity of the diurnal clock were more precisely studied.

Although it is still not known how the internal clock functions, it is known, for many organisms, where it is located. In higher animals with a nervous system, brain centres have been found which continue to produce a circadian rhythm independently and isolated from the sur-

rounding tissue. The important role of light for the circadian system also becomes clear from the anatomical position of these neuronal clock centres: without exception, they are either closely associated with the visual system or are themselves photosensitive.²⁴

In higher vertebrates, two clocks have been found in the central nervous system: the SCN (suprachiasmatic nucleus) in an area above the optic-nerve crossing and the pineal gland. The SCN receives input signals primarily from the eye and transmits its output signals, among others, to the pineal gland, which produces the hormone melatonin in a circadian rhythm. In some birds, it has been shown that the SCN signals are not a prerequisite for the rhythm in the pineal.²⁵ During the circadian night (i.e., under constant conditions in the laboratory environment"), the pineal cells produce more melatonin than during the circadian day. This is also true for cell cultures of pinealocytes and even for individual pineal cells. Melatonin affects many areas of the organism as the endogenous signal at night. The decoding of the circadian biochemistry of the pineal has thus far yielded the most knowledge about the molecular relationships of the clock in vertebrates²⁵ and has shifted the search

for the circadian oscillator to the cellular level.

The fact that single cells can also have a circadian clock has been known for 50 years and was first demonstrated with the aid of the circadian light orientation of unicellular freshwater algae.²⁶ Most chronobiological experiments with unicellular organisms are carried out on algae, but yeasts and fungi also have circadian clocks which are subjected to intense molecular and genetic research. The unicellular motile alga Gonyaulax is one of the most thoroughly studied circadian systems. It is particularly suited to circadian studies, because it produces light by a biochemical reaction in a 24-hour rhythm (figure 4).

With the aid of the Gonyaulax model, the molecular mechanisms of the in- and outputs of the circadian clock are now being carefully studied.^{27, 28} This knowledge will eventually lead to the description of the molecular clock work, whose mechanisms can then be looked for in other organisms.

The decoding of the circadian clock-work is one of the most exciting tasks in modern biology. This mechanism is one of the last biological phenomena still entirely unexplained. Chronobiological insights will not only yield important leads

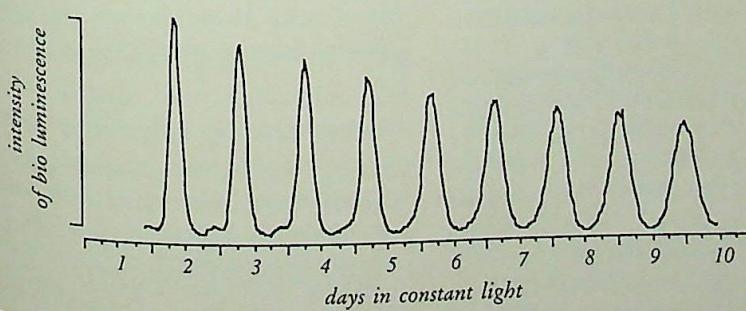


Fig. 4: The circadian bioluminescence of algae is particularly suited for research on the cellular circadian clock, as this rhythm is characterized by high precision and can be automatically recorded.

for the medical and psychiatric treatment of patients. They also pose new questions. What are the consequences, for example, of shielding ourselves from environmental signals or disregarding daily structures for the physiology of man, which has been controlled for many millions of years by endogenous clock systems synchronized with the environment by natural signals?

- ¹ Adam, K./Oswald, I.: Protein synthesis, bodily renewal and the sleep-wake cycle. In: Clinical Science, no. 65/1983, p. 561. — ² Elton, C./Nicholson, M.: The ten year cycle in members of the lynx in Canada. In: Journal of Animal Ecology, no. 11/1942, p. 215. — ³ Dawkins, R.: The blind watchmaker. London 1986. — ⁴ Halberg, F.: Physiologic 24-hour periodicity: General and procedural considerations with reference to the adrenal cycle. In: Zeitschrift für Vitamin-, Hormon- und Fermentforschung, No. 10/1959, p. 225. — ⁵ Gwinner, E.: Circannual clocks. Berlin, Heidelberg, New York 1986. — ⁶ Neumann, D.: Mechanismen für die zeitliche Anpassung von Verhaltens- und Entwicklungsleistungen an den Gezeitenzyklus. In: Verhandlungen der Deutschen Zoologischen Gesellschaft, no. 1976, p. 9. — ⁷ Aschoff, J. (ed.): Biological Rhythms, Handbook of Behavioral Neurobiology. vol. 4. New York, London 1981. — ⁸ Kräuchi, K./Wirz-Justice, A.: The four seasons: Food intake frequency in seasonal affective disorder in the course of a year. In: Psychiatry Research, no. 25/1988, p. 323. — ⁹ Lacoste, V./Wirz-Justice, A.: Seasonal variation in normal subjects: an update of variables current in depression research. In: N. E. Rosenthal/M. C. Blehar (eds.): Seasonal affective disorders. New York 1989. p. 167. — ¹⁰ Parkes, A. S.: Patterns of Sexuality and Reproduction. 1976. — ¹¹ Aschoff, J.: Twenty years on. In: B. K. Follett/D. E. Follett (eds.): Biological clocks in seasonal reproductive cycles. Bristol 1981. p. 277. — ¹² Wehr, T./Rosenthal, N. E.: Seasonality and affective illness. In: American Journal of Psychiatry, no. 146/1989, p. 829. — ¹³ Roenneberg, T./Aschoff, J.: Annual rhythm of human reproduction: I. Biology, Sociology, or both? In: Journal of Biological Rhythms, no. 5/1990, p. 195. — ¹⁴ Aschoff, J.: Annual rhythms in man. In: J. Aschoff (ed.) (note 7), p. 475. — ¹⁵ Roenneberg, T./Aschoff, J.: unpublished results. — ¹⁶ Roenneberg, T./Aschoff, J.: Annual rhythm of

- human reproduction: II. Environmental correlations. In: Journal of Biological Rhythms, no. 5/1990, p. 217. — ¹⁷ Neumann, D.: Tidal and Lunar Rhythms. In: J. Aschoff (ed.) (note 7), p. 351. — ¹⁸ Erken, H. G.: Der Einfluß des Mondlichts auf die Aktivitätsperiodik nachtaktiver Säugetiere. In: Oecologia (Berlin), no. 14/1974, p. 269. — ¹⁹ Cutler, W. B./Schleidt, W. M./Friedmann, E./Preti, G./Stern, R.: Lunar influences on the reproductive cycle in women. In: Human Biology, no. 59/1987, p. 959. — ²⁰ Richter, C. P.: Inherent 24-hour and lunar clock of a primate — the squirrel monkey. In: Communications in Behavioral Biology, no. 1/1968, p. 305. — ²¹ Holzhausen, K./Roenneberg, T.: Red and blue light have qualitatively different effects on the free-running circadian period of Canaries (*Serinus canaria*). In: VII Annual Meeting Europ. Soc. Chronobiol. Marburg 1991. — ²² Roenneberg, T./Hastings, J. W.: Two photoreceptors influence the circadian clock of a unicellular alga. In: Naturwissenschaften, no. 75/1988, p. 206. — ²³ Kasper, S./Wehr, T. A./Rosenthal, N. E.: Saisonal abhängige Depressionsformen (SAD) II: Beeinflussung durch Phototherapie und biologische Ergebnisse. In: Nervenarzt, no. 59/1988, p. 200. — ²⁴ Rusak, B./Zucker, I.: Neural regulation of circadian rhythms. In: Physiological Reviews, no. 59/1979, p. 449. — ²⁵ Takahashi, J. S./Murakami, N./Nikaido, S. S./Platt, B. L./Robertson, L. M.: The avian pineal, a vertebrate model system of the circadian oscillator: cellular regulation of circadian rhythm by light, second messengers, and macromolecular synthesis. In: Recent Progress in Hormone Research, no. 45/1990, p. 279. — ²⁶ Pohl, R.: Tagesrhythmus in phototaktischem Verhalten der Euglena gracilis. In: Zeitschrift für Naturforschung, no. 3/1948, p. 367. — ²⁷ Roenneberg, T./Hastings, J. W.: Are the effects of light on the phase and period of the Gonyaulax clock mediated by different pathways? In: Photochemistry and Photobiology, no. 53/1991, p. 525. — ²⁸ Morse, D./Fritz, L./Hastings, J. W.: What is the clock? Translational regulation of the circadian bioluminescence. In: Trends in Biochemical Sciences, no. 15/1990, p. 262.

Further literature:

- Bünning, E.: The Physiological Clock (3rd ed.). Springer-Verlag, New York 1973. — Moore-Ede, M. C./Sulzman, F. M./Fuller, C. A.: The Clocks that time us. Harvard University Press, Cambridge 1982. — Winfree, A. T.: The Timing of Biological Clocks. Scientific American Library 1987.

The Narrow Ridge of Life

The Ecological Challenge of Evolution

Bernhard Verbeek, Dortmund

It is becoming ever clearer that life is a phenomenon of material organization, information and regulation and that this is the prerequisite for spirit, culture and civilization. The following article extends from the start of life to the present, when the one species which has evolved culture, the "Homo sapiens", is endangering himself. This is partially due to the laws which are inherent to evolution, which not only human individuals but also the collective quasi-organisms of civilization are subject to. Avoidance of danger must be based on the hard reality and not on wishful thinking about the nature of man.

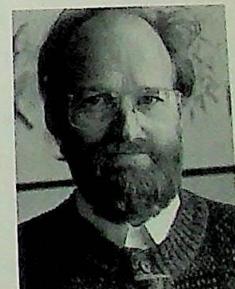
Life is an unusual force. Other laws seem to be valid here than in non-living nature. In the poetic language of our myth of creation God existed outside the world and formed the fertile earth of our planet into living creatures, even man, and breathed life into them.

Most nature religions too regard living material as having been animated. This presumably approaches our intuitive attitude to life and also corresponds to our whole occidental tradition, as seen in the entelechie of Aristotle or in the vital force ("vis vitalis") postulated by the vitalists and neovitalists.

In the meanwhile we have learnt more. We are familiar with cellular structures

down to molecular details and control mechanisms. We know that the laws of physics apply to living material without restriction. And there is every indication that if we could build an imitation of a grain of wheat, down to the molecular level, then this would definitely germinate and bear fruit. It would possess the force of life.

Professor Bernhard Verbeek is Professor of Zoology and of Biology Education at the University of Dortmund. Born in 1942, Student in Bonn, Kiel and Munich; Doctorate on the Ethology of Lizards in Bonn, 1971; University Lecturer in Dortmund, 1977. Publications on various experimental and theoretical subjects, particularly in ecology and ethology, epistemology and the psychology of perception. Most recent book published: *The Anthropology of Environmental Destruction. Evolution and the Shadow of the Future. (Die Anthropologie der Umweltzerstörung. Die Evolution und der Schatten der Zukunft.)* 1990.



Prof. Dr. Bernhard Verbeek,
FB Erziehungswissenschaft und Biologie,
Universität Dortmund, Emil-Figge-Straße 50,
4600 Dortmund 50 / Germany

Many see this molecular biological view of the world as shocking. However a very strong indication that it is correct is the fact that one can synthesize functioning genes. There is even already a "genetic typewriter", which is based on a computerized miniature laboratory. Either in the laboratory or in real life genes are produced according to a definite programme. The individual cells, the living organisms, populations and ecosystems work in accordance with these genetic programmes. The character of life is programme. Thus in the age of information science we have understood everything — you might think. But each genome has its programmatic peculiarities, dependences and autonomies. The interdependences are too vast to be comprehended. Only retrospectively does chance form itself into an aim; the improbable arises from randomness. Order in evolution appears out of chaos.

Now creation has reached its crown in man and man has the power. He creates what he sees as order. He widens his power whenever possible. He bases his claims on God's mercy or argues from a secular position. But he misinterprets the historical relationships. Almost everything becomes its opposite — order to chaos, tidiness to dirt — in the water, air and countryside. Everything is devilishly confused — health becomes disease, "Justice becomes injustice, a blessing becomes a curse", explains Mephistopheles in the guise of a university lecturer to the astonished student. "Fair is foul and foul is fair" screech the witches in their incantation in Macbeth, beautiful becomes ugly, ugly beautiful. Nature becomes culture and culture becomes monotony, barbarism, genocide and the death of species. Out of power arises powerlessness. What is happening

in the world? What has creation brought itself to?

The Most Modern and Most Ancient Epic

The biologist Edward O. Wilson, a radical representative of scientific materialism, described evolution as an epic, an epic of the greatest explanatory value. Many regard it as a dangerous rival to our traditional world myth. People still react in a disturbed fashion, reserved and hostile, and are often aggressive, because the old system of orientation has been put into question. It is quite possible to exclude the contradictions and inconsistencies from the various views of the world and to persist happily caged in the mental structure which you find secure. Stupidity is adaptive; it increases the ability to survive, as H. Geyer states in his ingenious if not totally serious essay on this uncanny phenomenon. However stupidity, particularly collective, can also bring total destruction. We should therefore try to break open as many mental cages as possible and to achieve a vision of nature which is as consistent and realistic as possible and which cannot be managed from one standpoint alone. We should not exclude or harmonize away, but, when necessary, revise old knowledge and integrate new.

Put exactly, the epic of evolution is the oldest that is conceivable. However it has only recently become legible for man. It has at least two things in common with the conventional world myth:

1. It is the normal matter of this earth which, in a suitable configuration, takes on life. This life is then evidently in the position of being able to resist adverse circumstances. For this it needs energy, the force of life, which it acquires from

outside the earth (as in the myth) — from the sun.

2. Creation has a history. This phenomenon of life is not only capable of holding on to complex information but can defy the hazards of chance and develop this information to ever more improbable peaks, up to mankind, as Teilhard de Chardin put it. At least at the human level a soul was then formed. The science of this soul is called psychology.

How Life is Nourished

All this can be observed, but at first glance seems to contradict the laws of thermodynamics, as these only permit development towards the more probable. However the dynamic system of a living creature accumulates energy and information and, if successful, resists the cosmic current of the increase in "entropy", which means the natural trend towards greater probability and less order. It is this relationship which makes perpetual motion impossible, which makes hot objects cool and cold objects warm, which blurs a message in the sand until it is illegible, which limits the extraordinary and trivializes the profound. Life does exactly the opposite of this: it orders chaos, collects and stores energy and is continuously in motion. It is therefore no wonder that a special vital force has been postulated, an entelechie, a spirit which stands outside the physical laws.

A second look shows that life does not contradict the law of the increase of entropy, but constructively exploits it to master the apparent problems arising from it. For this it created separate but open systems consisting of individual organisms. A very simple mechanical analogy shows how that is possible. A mill-wheel, which has no fixed axis but lies on a track

and which is driven from beneath by the down-stream, moves continuously up-stream (Fig.1). Another example is the yachtsman who can tack against the wind. "Natura non nisi parendo vincitur" as Francis Bacon wrote. Nature can only be mastered if you yield to her.

The present ecological system of the earth is essentially in equilibrium and will carry on as long as the sun delivers energy which can be taken up by plants. However we should not overlook the fact that this equilibrium is, strictly speaking, permanently unstable. As in any technology so in life must every expenditure of energy be paid for. Everywhere where life maintains itself above the threshold of existence, or even extends itself, a lot of potential energy must flow into the stream of entropy to fuel the expensive chemical energy of life. "Whenever an organism feeds there is negative entropy", as Erwin Schrödinger so aptly put it, with the linguistic informality fitting to a genius in physics.

Moreover, we should remember that the mirror of the present moving through time has a long and dramatic evolution behind it. The development is always proceeding and, under the influence of the past, produces what will soon become the past. Life arose about four thousand million years ago and at this time conditions on the earth were extremely improbable, perhaps even unique in the universe. These had been produced by a gigantic physical evolution, which is being more and more recognized with the increasing "historicization of physics" (Prigogine).

How Order Comes from Chaos

We can be sure that at the birth of life the earth's climate was not exactly friendly to

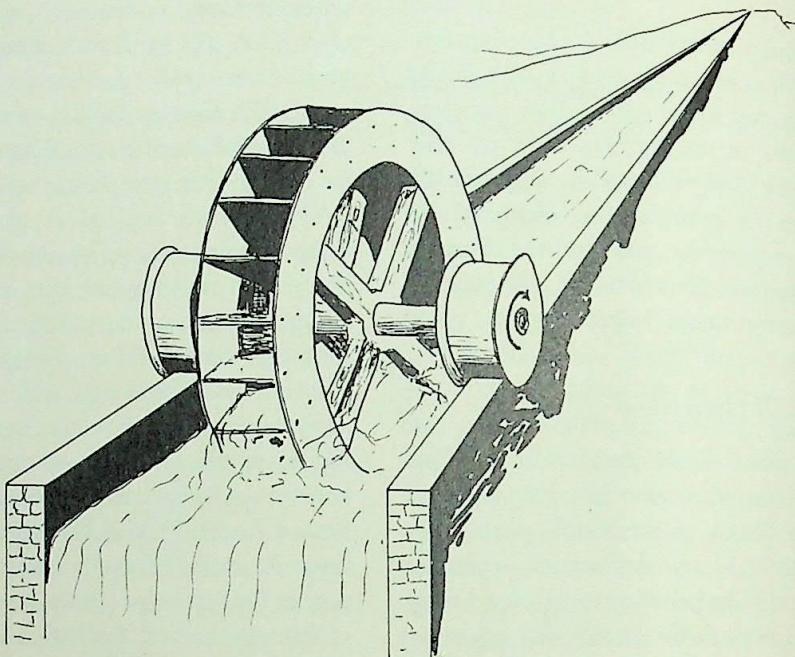


Fig. 1. A downhill stream can cause upward motion.

man. Not even free oxygen existed, but water vapour, methane, ammonia and large quantities of CO₂ led to a hot atmosphere. After the early arguments of Darwin and their development by Oparin, the exciting experiments of Miller and the studies of Eigen and of many others, the models for the formation of life from matter have become more and more plausible. We are beginning to understand how order came from chaos, how the information necessary to life developed further and how the carriers of information, known today as genes, created better and better mechanisms for their own protection and reproduction.

The components of the primaeval soup which provided energy were presumably quickly consumed. Once there were systems that lived to reproduce themselves, excess was converted to scarcity, exactly

as we know from economic systems. This first energy crisis was solved by the novel alternatives, the green photoautotrophs, which could live from sunshine. But these too were uninhibited in their exploitation and burdened the atmosphere. They consumed the carbon in CO₂, giving an equivalent quantity of oxygen, which was poisonous to organisms at this period. The oxygen was first released into the ocean where it oxidized dissolved bivalent iron, leading to deposits of ore, and then into the atmosphere, which was thus converted from reducing to oxidizing. In his provocative and well-known book "The Selfish Gene" Dawkins described how genes are exclusively there to ensure their own survival and that for this purpose they have created the most complex survival machines, which we usually call organisms. The genes then function as grey

eminences in the background and steer their gigantic reproductive apparatus ever more effectively. This is superficially an amusing idea, but when applied to man is usually felt to be insulting. The purpose of our existence is supposed to be the preservation of our genes? It may be better to return for the moment to the proto-biotic forms of ancient earth. We have fewer prejudices here.

The newly formed oxygen formed a layer of ozone, which protected life from UV-radiation. It also made it at least theoretically possible to extract energy very effectively by respiration. Chance and chaos continued to shake the almost unrestricted lottery of the genes. Perhaps only one of these "numbers" attained the configuration of the new necessity and could use the energy offered. Respiration had been invented, proved to be devastatingly successful and spread throughout the whole planet. The new programme was reproduced in an enormous edition and became a runaway hit. What is theoretically possible is ruthlessly and opportunistically converted into practice, if it is particularly lucrative. This advance of biological respiration is the opposite of photosynthesis. It is life from the death of others (aside from the respiration of modern green plants). All animals apart from bacteria and algae (which are summarized as destructors in ecological systems) live in this way. Some live directly from plants, others indirectly through an intermediate food chain. Biological success, the survival of the genetic programme, is the one and only value which can be recognized in prehuman evolution.

It may have been opportunism which lead to the appearance of respiring and metabolizing forms, but it was a piece of luck for the survival of the system, as it stopped the galloping extravagance with

raw materials and made a largely cyclical balance possible (Fig.2). Otherwise life would rapidly have run itself to death for lack of material, particularly of CO₂. At least it would not have risen above a very modest level and we would not have been in a position to worry about it.

What today appears to have been harmonically planned was only "retrospectively stabilized" and is the result of permanent creation, consisting of the continuous adaptation of life to its own results (Fig.3). It is the result of the continuous removal of the less harmonically adapted. Still the changes before civilization happened like the folding of a chain of mountains — so imperceptibly slowly that the living systems could adapt and produce an enormous multitude of forms.

How the Improbable Becomes Probable

The Law of Entropy can be aptly formulated as a tautology, namely: "The more probable will probably happen". The Garching physicist Peter Kafka emphasizes that this tautology also holds good for the realm of life. In the course of evolution the once improbable becomes probable, by the exclusion of other possibilities. We owe our existence to this fact, although it could also lead to our extinction. What is true for the evolution of organisms is also true for risk technologies. If the seas are full of tankers, if we have 10 000 nuclear power stations, if for some motive or other genetic engineering with gene fragments is carried out in every garage, then the improbable is no longer improbable. It will probably happen at some time.

Something new and exciting appears with the development of man. His genetic programme is so extraordinarily successful, because it allows its bearers the great-

est freedom. It is not like this with a termite, where the tiniest details about automatic behaviour are prescribed. The human programme allows the development and transmission of culture and civilization. A meta-evolution then proceeds, on a new level. This is more rapid and effective than biological evolution, but is still dependent on its support. Cultural innovation in man can spread like wildfire, without going the lethargic way of genetic mutation, selection and recombination.

However, the routes of meta-evolution must be judged by their success in the

real world. That which does not rise to the incredibly complex demands of real necessity, falls and is destroyed. Ideas, however good, for which our brains and civilization are inadequately prepared, phylogenetically and ontogenetically, suffer this fate. Everything must be in sufficient harmony with the environment.

Thus the lousy opportunism found in biogenetic evolution extends to epigenetic meta-evolution. This has been particularly acutely described by Harris in his book with the frivolously sounding title "Cannibals and Kings", from the point of view of the chain of events,

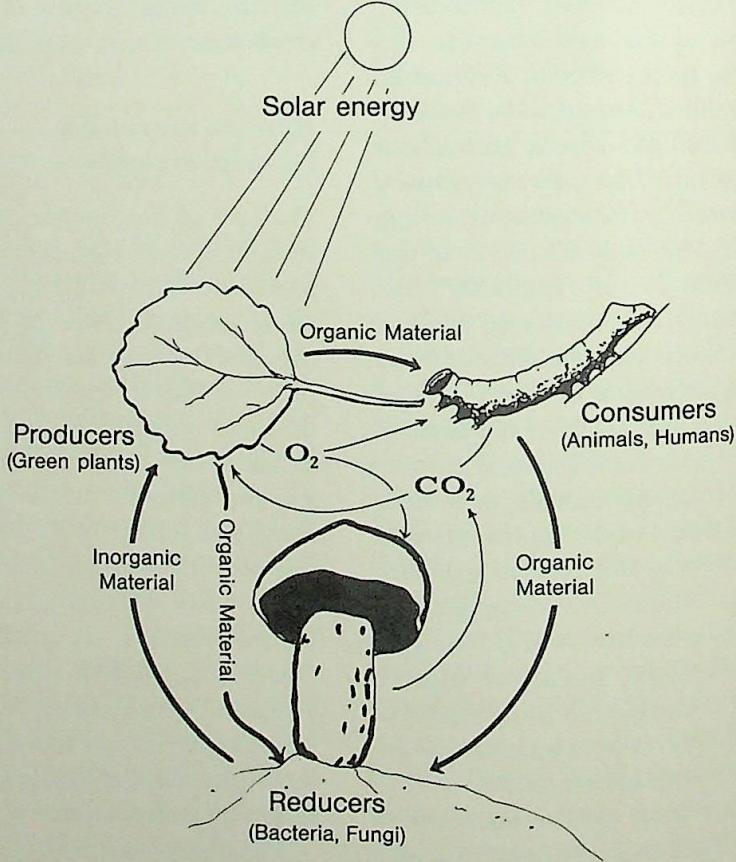


Fig. 2. The ecosystem. Energy from the sun is taken up by organisms and released first into the environment and then into space. This process is accompanied by an increase in entropy. The materials are subject to cycles.

above all in cultural ecology, which led to the rise and fall of numerous civilizations. The evolutionary biologist sees here the same principle as in non-human development. Resources were used whenever possible; readiness to do without only developed under the force of circumstances; rationality only apparently ruled. Traditions and the demands of cults which have proved themselves in practice are obeyed without reflection, like instincts, and are the most effective ways of regulating behaviour. Cultures which do not pay long-term attention to ecological requirements simply die out. For a limited time their deficits can be made good by expansion and robbery. Man has never understood his systems, but has always justified them.

Now back to the problem of the narrow ridge of life. Prehuman animals can, as discussed, only extract energy by respiration by combining energy-rich formerly living material with oxygen. No more

energy can be extracted than the available food allows. This changes with an important step in the evolution of man: the use of fire. This opens totally new resources to him. It is the extension of respiration by other means, coarse and immoderate. However it is also successful against competitors who do not have this possibility, just like war, which is painfully similar to what we read in Clausewitz.

Just like war, combustion has been enormously improved since the first invention of combustion machines. No alteration in the world should now fail because of lack of energy — you simply produce more. The basis of the history of the earth is attacked; reduced carbon is taken from the earth's crust and combined again with oxygen to form CO₂. Man does in principle what has always happened in evolution, but for which other creatures did not have the technology — the exploitation of hidden reserves of energy. With the help of new technol-



Fig. 3 Evolution is like a sculptor who tries to sculpt the available material into something as close as possible to his ideal — the overall ability of a form of life to survive the so-called inclusive fitness. Selection is the tool with which the most harmonious structures are chipped out. Through this process creation achieves ever newer "images" and directions. It is this dynamic, in contrast to sculpture in stone — and can also destroy the forms and systems which have been developed.

ogy fire is brought into coal seams, into oil fields and into the rain forest, where it would have no chance without chain saws.

The work of man means that the restricted harmony on the whole earth is no longer guaranteed for many species. The evolutionary introduction of respiration three and a half thousand million years ago created long-term possibilities for life. However, in spite of all the indisputable and impressive technological progress, the abrupt consumption of fossil and life resources signifies a dramatic regression in the evolution of life. CO₂ increases; O₂ decreases. Worse than the reduction in oxygen is the disappearance of species. Reliable but approximate calculations show that at the moment about 10 000 times as many species are dying out as new ones can arise, which is a holocaust for the biosphere. A species dies out perhaps every hour. There have been enough recent conferences on the climatic phenomena which accompany us on the way back to the chaos of the primaeva earth — but too few consequences have been drawn.

It is not immediately evident that what is happening at the moment on our populated planet is really so bad. Man is doing just what the continuous competition of evolution has bred him to do, indeed what all living creatures do: using resources to reproduce his own genome.

The Moral Dimension

There are however some differences between us and other living creatures. His advanced intellectual development has allowed man to build up a technical civilization. The individual elements of this have acquired their own dynamism, a

quasi-organismic independence, of which some day man will no longer be the master, or perhaps already is not — only we have not noticed it yet. Either consciously, or unconsciously these higher units of civilization, such as states, concerns or uncontrollable parties, develop an expansive and self-serving character, analogously to the laws for genetic evolution. Above all these quasi-organisms do this without any consideration at all for the environment — just like the opportunism which is inherent to evolution. Today living humans are sometimes, but rarely enough, able to defend themselves. Future generations are not able to do this. It is exactly the same with the non-human creation.

A further specific characteristic of human evolution is our ability to see consequences, for a limited forecast of the future. Our activity then acquires a dimension which is totally new for evolution, a moral dimension. You might think that this would help us to solve our problems.

This however overlooks the fact that individuals and whole communities live on a communally used planet of restricted size, under the pressure or demands of perpetual growth. Without efficient regulation this must turn into a tragedy, "the tragedy of the commons"²⁵ Garrett Hardin put it. Everyone takes as much as he can from the common human property, but he calls on the others to do without. For reasons of fitness the individual can hardly behave differently; but for exactly these reasons he must dispute this, in as credible and as sanctimonious a fashion as possible. According to Hardin, moral appeals have two essential components:

1. (intended communication) "If you don't do as we ask, we will openly co-

you for not acting like a responsible citizen." (the unintended communication) "If you do behave as we ask, we will secretly condemn you as a simpleton who can be shamed into standing aside while the rest of us exploit the commons."

Neither lamentation nor, even less, appeals will remove these problems. The longed for "new man" will not come in the future either, just as two thousand years of Christianity, fourteen hundred years of Islam, and about a century of Marxism have failed to produce him, not

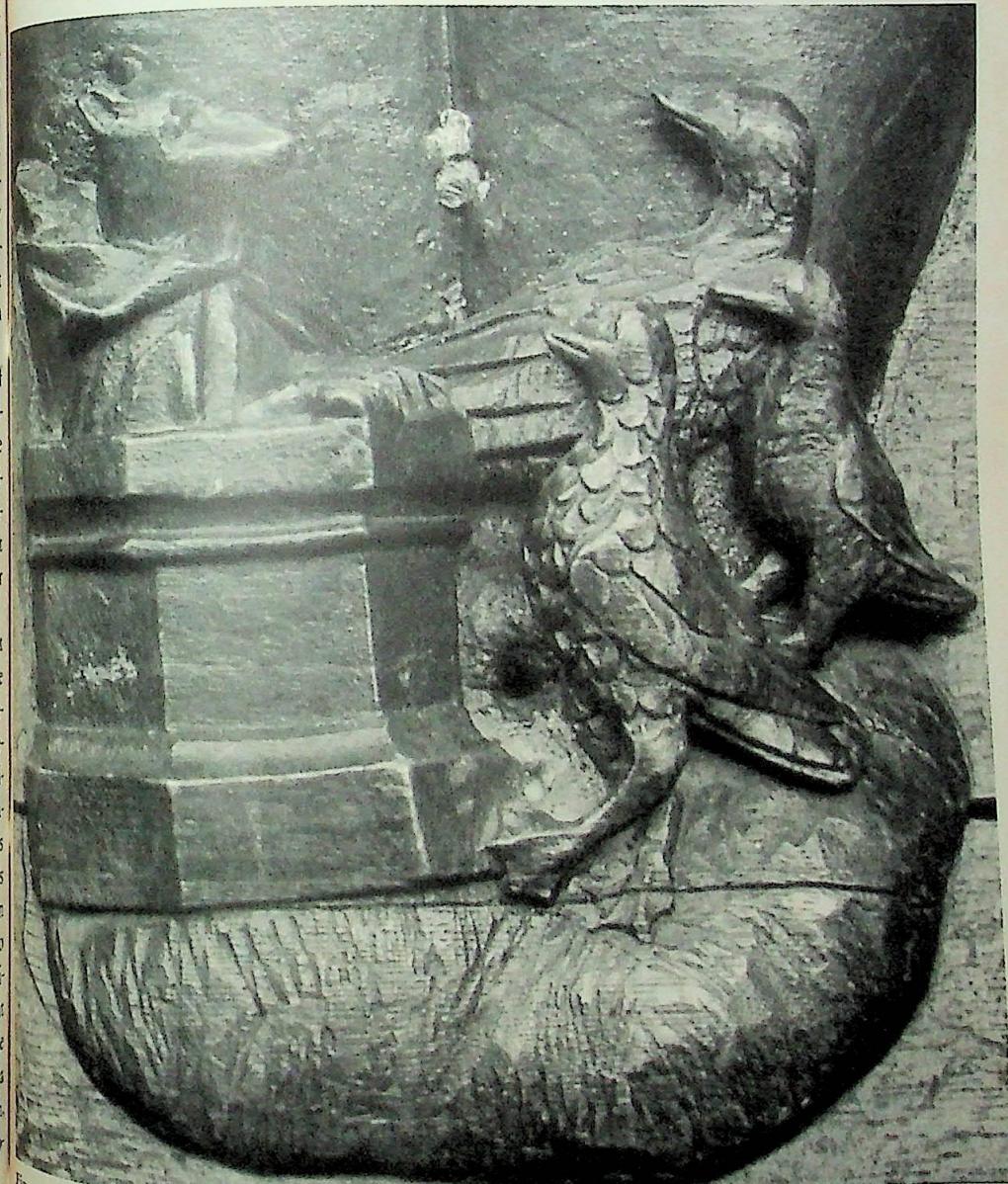


Fig. 4. "The fox preaches to the geese." The occasional immoral motivation of moral appeals had already struck humorously and critical spirits in the 16th century. Detail from the choir stalls (1509 to 1520) of the Collegiate Church of St. John in Cappenberg, Westphalia, former Premonstratensian choral foundation for men.

to mention the schools of psychology and education which hope to improve the world. The desired *Homo oecologicus* may exist here or there as an exception, for the delight of others. He is more likely to be laughed at than admired and is subject to hostility, as someone who transgresses the rules of normal behaviour. However the atmosphere, both economic and ecological, is produced by the powerful, who unscrupulously exploit our resources. At the moment the culture of noble and environmentally friendly human beings has no chance of surviving and expanding in the world.

A New Plan

What can be done to remedy this depressing situation? A planned economy obviously does not help at all. It is quite inherently inconsistent with the freely innovative principles of evolution. However the market economy, as we know it, is also clearly no good at all. Now, either from predictive insight or from unfortunate experience, man has already made written or unwritten rules of behaviour and adherence to these is energetically forced through. Man's genetic programme demands rather than permits this, as he is a cultural being.

Like the rules of a language these practised rules are imprinted and internalized and are mostly seen as incontrovertible — in religiously influenced older cultures they are seen as God given. In earlier generations there was no reason to include an imperative to preserve the earth's atmosphere, rather than to reproduce, or to protect species of animals and plants, which used to be regarded as vermin and weeds. It is now high time to do this, and I see this as the only helpful approach.

This new law of civilization must be as the only helpful approach. This new law of civilization must be as unassailable by lobbyists as any law of nature. Recently a quite similar position has also been supported by jurists (Helsper).

The most important new "natural law" made by humans to preserve a world that was suited for man and which could exist with real men would be as follows. If you consume non-regenerable resources you must be forced to pay a lot, with excessive use perhaps on a sharply rising scale. No mortgage on the future will be granted. In exchange, the state can reduce or abolish all other taxes. These and similar conditions could help to create an evolution of civilization in which, in contrast to now, only environmentally friendly creations could thrive: no extravagance with energy, no flood of packaging, no car madness, no unoccupied gigantic flats in spite of lack of accommodation for many. In exchange we could get: fresh air, climate (both meteorological and psychological) which was friendly to life, nature which was worth experiencing, a chance for the old, the handicapped, for children and for the future. We cannot promise paradise, but we can avoid hell.

It must be admitted that the conditions I have suggested are not in the short-term interest of certain mighty meta-organisms and it must be feared that the short-term interests of most people at the moment are also at variance. However a civilization that intends to survive should be able to separate itself from the impressive but necrophilic aspects of technology and agree to the narrow but delightful ridge of life.

If humanity cannot unite on this, then our design by evolution has proved to be unserviceable and — as Stanley Milgram

once put it coolly in another context — evolution will try another throw of the dice. The crowning glory of evolution will then have programmed his own end.

English translation by R. A. Yeates

Requires of the Law. (Die Vorschriften der Evolution für das Recht.) Cologne 1989. — *Kafka, P.*: The Law of Development. But What is Progress? (Das Gesetz des Aufstiegs. Fortschritt — was ist das eigentlich?) In: M. Faulstich/K. Lorber (Eds.): Unitary Environmental Protection. (Ganzheitlicher Umweltschutz.) Stuttgart 1990. pp. 59-73. — *Prigogine, I.*: The Physicochemical Roots of Life. (Die physikalisch-chemischen Wurzeln des Lebens.) In: H. Meier (Ed.): The Challenge of Evolutionary Biology. (Die Herausforderung der Evolutionsbiologie.) Munich, Zurich 1988. pp. 19-52. — *Schrödinger, E.*: What is Life? The Physical Aspect of the Living Cell. Cambridge 1944. Cited from the German Translation: Was ist Leben? Die lebende Zelle mit den Augen des Physikers betrachtet. Munich 1952. — *Wilson, E. O.*: On Human Nature. Cambridge 1978. German: Biologie als Schicksal. Die soziobiologischen Grundlagen menschlichen Verhaltens. Berlin 1980.

SPECTRUM

Archaeology

How "Modern Man" Came to Europe from Africa

(df). That modern man, *Homo erectus*, evolved in Africa and then gradually set out towards Europe on the long journey to colder regions, is hardly subject to scientific debate today. However, the theories and suspicions regarding the direction early man once took are diverse. Thanks to the sensational discovery of a human mandible estimated to be 1.6 to 1.7 million years old by German archaeologists in the Caucasus (Georgia) amongst many animal bones in a cellar pit of a medieval ruin in Dmanisi, it now seems proven that the earliest route man took from Africa to Europe was via Eurasia, the land between the Black and Caspian Seas.

The much later date determined for settlement in Europe, which was regarded as verified till now on the basis of discoveries of approximately 700,000 and 500,000 years' age made in Prague and Heidelberg, respectively, must also be revised because of the Caucasian mandible. The Prague and Heidelberg discoveries, however, are from a period in which a second route to Europe had been found via the Strait of Gibraltar. This research project began with an invitation extended by the Georgian Academy of Sciences to the Research Institute for the Palaeolithic Period of the Roman-Germanic Central Museum in Mainz, which its director, Professor Gerhard

Bosinski of Cologne University, who speaks Russian fluently, and his assistant, Dr. Antje Jus-tus, took up in the late summer of 1991. They had been asked to give their expertise on a Palaeolithic finding their Georgian colleagues had discovered beneath the ruins of a medieval city.

The excavation site is inside the now uninhabited city of Dmanisi, some 84 kilometers from Tbilissi near the Armenian border. The site, which was a major fortification in the 12th and 13th centuries on the main Caucasian trade route to the countries of the Near East, is located on a triangular plateau rising between two river valleys over a stream of basalt lava, which

plays a crucial role in the preservation and study of Stone Age remains. "It is the oldest finding site with artefacts and evidence of human activity in the Caucasus region," explained Bosinski.

The other monuments of the city, which still has ten-meter-high walls of the former citadel, were described for the first time in 1853, a few inscriptions were deciphered and graves examined, but not until the early 1980's did the Georgian director of the excavations, V. Dzparidze, discover a wide variety of animal bones from the early Ice Age in three-meters-deep pits, some of them smashed. Apparently the bones were also leftovers of meals. When the fragment of a rhinoceros tooth was clearly identified by the Georgian archaeologist A. Vekua and later Palaeolithic tools made of tufa, as well, this was the impetus for further research. This included pollen and seed analyses to reconstruct from them the environmental conditions of the time, pointing to differing ecosystems — from open grassland to deciduous trees such as oak and beech down to areas wooded with firs and pines. The varieties of the fauna around man was

correspondingly great. In it, an early immigrant from Africa can be found, the ostrich, which, compared to a skeletal finding from the Olduvai Gorge at the edge of the Serengeti in Africa, must have been even huger in Caucasia; thus, this "Struthio dmanensis," in Nekua's words, "outdoes all fossil and recent ostriches in size."

The area which Bosinski first investigated was some 5,000 square meters large. At one point an exploratory shaft three meters deep was dug as a test. Chance had it that this "profile cut" was done at the "right" place, and the result was a "decisive moment in prehistory." What was turned up in the upper portion did not look very promising at first: only gravel tools beaten into shape and a few bones. The density of findings and variety didn't get more revealing until over half a meter deeper. There the right forepaw of a hare and an elephant vertebra and the skull of a young rhinoceros with all its deciduous teeth intact were discovered. Between the incisors of a horse and deer, stag antlers were found in the proximity of a wolf's skull. The bones of a land turtle were further evidence of the fauna of the period. The outstanding discovery in a veritable concentration of bones consisted of two skulls of sabre-toothed tigers (*Machairodontos*), one of them even with a complete cervical spine and thoracic vertebrae in anatomical conjunction, and nearby — cervical vertebrae and a foot-bone of a steppe elephant in a diagonal position. The bone

fragments were only in part recognizable and were piled in a near tangle, so that the utmost care was required in uncovering them. Finally, just a hand's breadth under the first sabre-toothed-tiger skull — and only 20 centimeters above the layer of black volcanic ash — a bone with a semicircular curve surprisingly turned up. A first tooth was revealed — it was a human mandible with 16 well preserved teeth pointing downwards. Right next to it was a stone tool.

The age of the prehistoric man to whom this mandible belonged is estimated, on the basis of the signs of wear of his teeth, to be 20 to 24 years; the age of the deposit period in which the discovery was made is estimated by Bosinski to be 1.7 to 1.6 million years. Preliminary dating of the jawbone by the vulcanologist Professor Hans-Ulrich Schmincke of the University of Kiel is in agree-

ment with this. A further dating of the discovery which is now being studied and preserved in the Roman-German Central Museum in Mainz, is planned to be performed in the United States.

The mandible is relatively slender and is evidence of a receding chin and displays a mosaic of characteristics which are typical of the archaic *Homo erectus* and in part of still older forms. Striking and mysterious is an injury of the mandible: the rami are missing. Perhaps the Caucasian man was the victim of a fatal hunting accident and the man's head — as befit his importance — was brought back to the camp with the kill to take the brain out of his skull. Like with many prehistoric peoples, cultic cannibalism, the archaeologists point out, should not be ruled out, but it could mean that Caucasian man had already developed a mentality of his own.

Geoarchaeology

Has the Riddle of the Lost Continent Been Solved?

(df). For over two millenia, people have been wondering about the legendary Atlantis, of which there is only one description, stemming from the Greek philosopher Plato (427–347 B.C.). The sunken island has been suspected of having been located just about everywhere. The geoarchaeologist Dr. Eberhard Zanger of the German Archaeological Institute in Athens has now put forth the scientifically supported thesis that for his description of Atlantis, Plato simply exploited an historic report from Egypt on the city of Troy, the city on the west coast of Asia Minor which was world-renowned even in antiquity.

Since antiquity, the Atlantis story has inspired scholars, writers, adventurers, and lunatics. The number of books and articles in scholarly journals on the "Lost Continent" has

reached the millions by now. Over 40 places throughout the world can be listed where Atlantis has been suspected to be, among them the Arctic, Heligoland, and outer space.

With his book, "Atlantis – eine Legende wird entziffert" ['Atlantis: the Deciphering of a Legend'] (Verlag Droemer Knauer, Munich 1992), Zangerer has now renewed the debate on the mysterious island city.

The Atlantis story goes back to a conversation conducted in the 6th century B.C. by the Greek statesman Solon (640 to 560 B.C.) and a priest in Saïs, the capital of Egypt at the time. Plato recapitulated the purported legend of his forerunner Solon in 360 B.C. in the dialogues "Timaeus" and "Kritias," thus handing it down to posterity, which, however, usually consigned it to the realm of pure fiction. Thus, Plato's description has its roots in something which was related several centuries earlier in Egypt and in which the Egyptian priest confused the Greek landscapes of Attica and the Plane of Argolis on the Peloponnesian peninsula. The reader learns there that a Greek civilization – the culture of the late Bronze Age – was de-

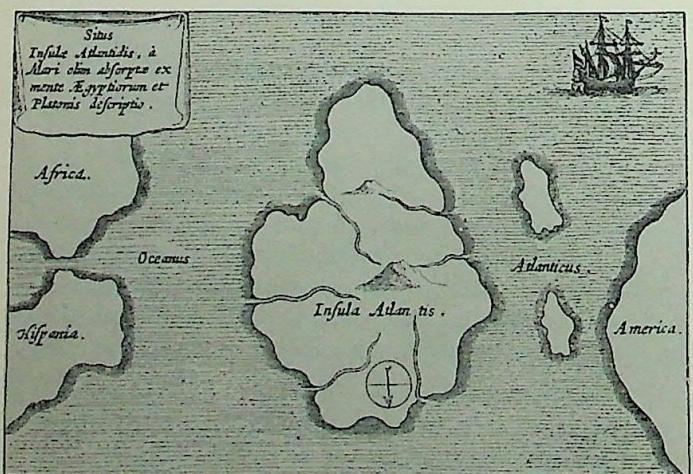
stroyed by simultaneously occurring earthquakes and tidal waves.

For ten years, Zangerer studied early Greek culture and its natural surroundings. Drillings in the area around Tiryns revealed traces of a large landslide and a flood catastrophe which buried the outlying areas of the Mycenaean fortress of Tiryns under meters-high rubble 3,200 years ago. The disaster was caused by an earthquake, as German research has since revealed. It must have been a period of catastrophes, for many other Mycenaean settlements were destroyed at that time.

The demise of Mycenaean culture runs parallel to the decline of many states of the Eastern Mediterranean region in the late Bronze Age. This phenomenon in particular is mentioned by Plato. The collapse in the Argolis as well as in the states of the Mediterranean was handed down by oral tradition and then in Solon's relation on Atlantis. In Zangerer's view, Plato's Atlantis tale is the story of the

great catastrophe around 1200 B.C., when most Mycenaean palaces were destroyed by mud slides, earthquakes, and fire. Solon's informant and interlocutor, the priest of Saïs, combined this catastrophic scenario with the legendary city of Atlantis. At this point Zangerer begins his textual criticism and cites suspicions uttered by Plato's pupil Aristotle and 19th-century English theories. He claims that the priest of Saïs enriched his relation puzzle with a description of Troy/Atlantis, which was located where the Dardanelles empty into the Mediterranean. The description of the landscape around Atlantis alone, Zangerer points out, agrees with the surroundings of Troy.

The Egyptian priest relates that Atlantis was an island in the "Atlantic Sea" at the "Pillars of Hercules" – two characteristics which seemingly contradict the identity of Troy with Atlantis. Zangerer explains this contradiction by pointing out that in ancient Egypt, Greece, to its north, was considered a conglomeration of islands, and the countries in and around the Aegean Sea were called "the islands." And the "Pillars of Hercules" were in Solon's time none other than the Dardanelles, the roughly one-to-seven-kilometers-wide strait between the Marmara Sea and the Aegean. Even as late as late Roman antiquity, people called the Dardanelles the "Pillars of Hercules" as well as the Strait of Gibraltar. Moreover, when Solon was alive, Gibraltar, unlike the Dardanelles, was beyond the range of the ships in the Eastern Mediterranean.



The location of the sunken island Atlantis according to the description of Plato (Illustration by Athanasius Kircher, 1601 to 1680).

(Photo: Archiv für Kunst und Geschichte)

Genetic Engineering**Foodstuffs from the Genetic Laboratory**

Fulda (fwt). How would it be if spoiled yoghurt turned red as a warning to consumers? Or violet, or green? The present state of genetic engineering would make this possible. This science has brought great advancements to medicine in recent years. But research scientists have long since stopped manipulating genetic codes just to produce medicines or treat diseases. They also change the genes of carps and tomatoes, potatoes, rape, and cereals. In the coming years such products will also be found on the shelves of German supermarkets, too. At a seminar of the German Nutrition Society (Deutsche Gesellschaft für Ernährung), scientists discussed the advantages and disadvantages of these "new foodstuffs."

Foodstuffs of this kind are still growing almost exclusively in research laboratories, but in the United States the "supertomato," for example, is already on the market. It is said to be bigger and more durable than its nonmanipulated cousins, as Jörg Landsmann of the Institute of Biochemistry and Plant Virology in Braunschweig explained. The taste of the "supertomato" has also been improved by genetic engineering, its spiritual fathers claim.

With the implementation of the European internal market, cheese from Holland will someday come to German supermarkets which has been produced with genetically manipulated rennin — a substance that makes milk coagulate. Using this rennin as an example, the Dutch scientist Dick Arie Toet explained what advantages foodstuffs produced by genetic engineering can have for industry, but what difficulties they have in gaining consumer acceptance. For the dairies, the development of this artificial rennin, chymosin, was an advantage. Until then, rennin could only be obtained from

the stomachs of slaughtered calves, but it is only two percent pure. Chymosin, the product of genetic engineering, is in contrast nearly one hundred percent pure and is available in nearly any amount, Toet declared. This is another decisive advantage for the producers, for veal has lost in popularity in Holland in recent years. As a result, veal production went down and with it the supply of rennin.

The Swiss Wouldn't Buy the Cheese

However, when an attempt was made to use the chymosin from the genetic laboratory in cheese production in Switzerland, as well, the consumers went on strike: the cheese was left on the supermarket shelves. And this although scientists had demonstrated that chymosin is no different chemically from traditional rennin from calves. The distrust of the consumer towards a technology which is directed at the foundations of life is apparently deepseated. A seriously ill person is probably willing to grasp the straw of a therapy with products of ge-

Even the term "Atlantic Sea" is misleading, for it didn't come into use until about 100 years after Solon's stay in Egypt and was thus added to the description of Atlantis by Plato. The name "Atlantis" alone tells where it once was, for translated from the Greek the name means "daughter of Atlas." And a chance would have it, Atlas was the progenitor of the Trojan royal house.

Plato relates that Atlantis was surrounded by rings of water and that the people of Atlantis built a canal from the sea to the outermost ring of water around the city. There is a great deal of evidence for that, too, Zanger writes, for the Plain of Troy is teeming with old canals and inexplicable heaps of sand. The heaps of sand, which the discoverer of Troy, Heinrich Schliemann, had already taken note of, are in Zanger's opinion nothing less than the material dug up while constructing artificial ditches. The large water canal also exists near Troy, for nearly every topographical map of the Trojan Plain registered a 9-km-long waterway in the direction of the acropolis of Troy. But unfortunately this canal has as yet not been dated.

Troy/Atlantis was in Zanger's view nothing more than a kind of seaside city which, because of its geographical location linking two continents and two seas, dominated navigation between the Aegean and Black Seas and levied taxes for pilot services and harbour use. Troy was something like today's "last filling station before the motorway" — Troy was the gateway to the Black Sea.

netic engineering. But someone who is just hungry will see no necessity of eating manipulated foodstuffs — at least not as long as there is something else.

However, millions of starving people wouldn't be bothered by manipulated millet if it just saved them from starving to death. Thus, Professor Klaus Jany of the Federal Nutrition Research Institute (Bundesforschungsanstalt für Ernährung) emphatically cited the possibility that with the aid of this technology, foodstuffs could be produced for the hunger regions of the earth. But critics point out that if these new foodstuffs were used in the developing countries, they could again become dependent on the industrial nations who have the required know-how. Besides, these products required a special fertilizer which the developing countries would have to go to great expense to acquire. Also, it could be that genetically manipulated grain seeds would not be suitable for re-sowing. The farmers would then have to buy new seeds each time.

The new foodstuffs surely are more feasible in the borderline area between medicine and nutrition. For example, proteins produced by genetic engineering could be a considerable boon to the diet of people suffering from phenylketonuria. In some cases, the production of genetically manipulated foodstuffs may thus be justified. However, the advantages often seem to be entirely on the side of industry. Nobody knows exactly what is going to land on the grocery shelves.

Crime

The Call for Redemption Is Getting Quieter

(df). According to one cynical theory, people are lenient and indulgent towards criminals as long as their crimes aren't committed against them personally. If that were true, the attitude towards crime should get tougher when more and more people are the victims of criminal activity. Results of new data show, however, that the redemptive urge is independent of the number of the offences and personal experience with lawbreakers.

The number of reported crimes, about 2.4 million in 1970, has meanwhile increased to about double that figure, according to police statistics. Many observers believe that the rise in the crime rate has an unavoidable effect on the population's general attitude towards life, Dr. Karl-Heinz Reuband of the Central Archives for Social Research at the University of Cologne comments in the "Zeitschrift für Soziologie" (no. 2, 1992). Indeed, not only the number of direct victims is growing, but also that of the subjectively endangered persons who hear about criminal occurrences in their circle of acquaintances or through the media. It thus seems safe to assume that those affected are concerned and express the wish that the police and courts "get tough."

To test this hypothesis, Professor Reuband analysed several representative polls on crime conducted in recent decades. According to the results, there is no correlation between the "objective" and "subjective" crime rate. The number of people questioned who said they had been robbed fluctuated since 1960 between a minimum of 20 percent and a maximum of 27 percent. "From a subjective perspective, the pop-

ulation of the Federal Republic apparently doesn't feel increasingly victimized by criminal acts," Reuband concludes from these data. The actual increase in crime is not reflected in the population's consciousness.

The fear of becoming a victim of crime oneself even decreased during the period under study. Whereas 43 percent of the population knew of a place in their neighbourhood where they wouldn't like to be alone at night in 1965, this figure was only 35 percent in 1990. The concern that there could be an increase in "crime" decreased already in the 70's and has remained largely stable since then. In 1972, 33 percent of those polled felt more jeopardized than "three years ago." In 1980, only 24 percent of the population shared this concern. Collective anxiety apparently does not come from crime itself, but from completely different causes.

Possibly the population is so "saturated" by the economic upswing, Professor Reuband suspects, that certain material setbacks "are more easily made up for" than in former times. Perhaps other developments have solidified the feeling of personal control and security so much that the figures are no

longer alarming. The fear of crime in the neighbourhood did in fact decrease the most in women, Reuband emphasizes. The repressive attitude, i. e., the call for law and order, has decreased even more in recent years than the fear of crime. Whereas in 1970 80 percent of the population regarded protection from crime as "very important," only about half agrees with this evaluation today. The number of people who give absolute priority to maintaining law and order decreased in these years from 63 to 40 percent. The call for capital punishment and other draconian measures also has fewer and fewer followers in the German population.

But this general trend does not permit any statements to be made regarding whether persons directly affected by crime are in favour of a particularly strict philosophy of crime and punishment. The criminologist Dr. Klaus Boers of the University of Tübingen and Professor Klaus Sessar of the University of Hamburg conducted a poll of about 1800 randomly selected persons to study this question. Males and the elderly amongst those polled take up a tougher stance than do women and young people, the researchers report in the book edited by Sessar and Hans-Jürgen Kerner, "Development in Crime and Crime Control Research" (Springer Verlag, New York). However, the call for punishment and redemption is not more prevalent amongst crime victims than with people who have (thus far) had no negative experience with crime. So the role of victim does not make

people vengeful. And even the people who express particular fear of crime do not have more repressive attitudes than others.

The tough stance towards crime is apparently more dependent on rigidly established values rooted in tradition than on personal experience or the degree of insecurity, the two experts explain. In the course of their development, people form relatively solid "systems of belief" which determine the intellectual and emotional reaction to future topics and events. The personal background, parental upbringing, contacts with other people, the influence of the media, and perhaps even genetic predispositions shape the intellectual corset which roughly establishes the ideological direction. Some people who are very afraid of crime perhaps really do insist on tough measures because this thought is soothing. Other intimidated people, on the other hand, are possibly very empathetic and for this reason shy away from sharp sanctions against criminals.

But the cultural and historical background also influences attitudes towards crime, as Reuband illustrates using the example of the former GDR. Data on (increasing) crime rates were systematically hushed up there. Only now, when the media can for the first time report on this "uninhibitedly," people are becoming fully aware of this sinister side of life. The people in Germany's East also immediately reacted by feeling much more insecure about crime than their compatriots in the western states.

Cell Biology

Urea Against Neurodermatitis

(df). Urea, formerly a medicine in frequent use in popular medicine, has become a source of hope in the treatment of neurodermatitis, an itching atopic eczema of unknown causes, of which dermatologists suspect that it could become more and more frequent due to environmental pollution.

As the final product of protein metabolism, urea, which is mainly present in urine and sweat, has the important property for treatment of neurodermatitis of penetrating the very dry layers of skin and absorbing dampness. Just how this happens has been studied by Professor Wolfgang A. Wohlraab at the University of Halle in long years of work. The cell biologist, the only one in the world who has studied the effects and possible uses of urea so comprehensively, arrived at the surprising result that the penetration of the skin by this dampness-adsorber depends on the base used in preparing the pharmaceutical agent. It has a longer-lasting effect in a water/oil base than in an oil/water one, i. e., one in which oil is the predominant component. In combatting the symptoms of the disease, such urea-containing pharmaca, when applied once, have a humectant effect of several hours, whereas the effects of daily application become long-term and even continue for a few days after application has been discontinued. In addition, the anti-inflamma-

tory effect of "hydrocortisone," which is actually a weakly effective cortisone preparation which therefore has few side effects, can be increased when combined with urea by 10 to 14 times in various areas of the skin, with "little to no side effects." According to Wohlrab,

the proportion of urea in this should be seven to twelve percent; a higher concentration would be pointless, in his opinion, and a lower one without effect. Professor Wohlrab warns, however, not to use urea preparations of any kind without consulting the doctor.

Medicine

Skin Replacement for Burn Victims

(df). In cases of severe burns, there is often not enough skin material available for transplantation, as strange skin is rejected. Scientists in Aachen have now developed a "Chinese skin replacement" further and automated its production. It affords a functional replacement which is accepted by the body even when it comes from a donor.

The skin is more than just the body's "packaging." It wards off pathogens, provides protection from injuries, and not least contributes to maintaining a constant body temperature. Just how important it is, can be seen in the case of burns. When the dermatoid protective wall collapses, there is the danger of infections and loss of fluids. The larger the wound, the more difficult it is for the doctor to repair the defect with the patient's own skin. For the body does not accept the skin of other people.

For years surgeons have been looking frantically for alternatives and usually use a product combining synthetic materials and natural-skin elements. At the University Clinic for Burn and Plastic Reconstructive Surgery in Aachen, Professor Rolf Hettich and his working group have developed a further promising version of this mixed skin. It is based on the great successes of Chinese scientists in the 70's: patients whose

skin was almost completely burned were saved there by transplantations of "mixed skin." In a multi-year project subsidized by the Federal Ministry of Research and Technology (BMFT), the Aachen scientists also developed an apparatus with which this mixed skin can be produced.

Human skin consists of two layers, the upper skin or epidermis and the true skin underneath it, which is called the corium in medicine. Defects on the surface of the skin usually heal spontaneously when the cells of the epidermis multiply, thus closing the wound without leaving a scar. When the corium or the tissue beneath it are damaged, scars form when the wound heals, however, and they can contract. Then it is up to the surgeon to remove the damaged tissue and cover the defect by means of a skin transplantation. With a fine "electric plane" he removes intact portions of skin which are at most .3 millimeters thick and contain

equal amounts of epidermis and corium. These he transplants to the place of the wound, usually without major problems, as the covered wound and the defect at the point of skin removal generally heal well.

However, difficulties arise when more areas of skin are burned than there are still healthy replacements available on the body. Then recourse must be taken to mixed skin, to skin strips from donors into which holes are punched about every three centimeters. Into the holes epidermis is placed which has been taken from the patient. If an even more economical use of the patient's skin is appropriate, epithelium cells of the epidermis can be multiplied in a test-tube.

In contrast to skin entirely from the donor, the heterocorium is not rejected. Rather it fuses with the body's own epithelium cells to a utilizable alternative skin, the Aachen scientists determined in animal experiments and with patients. They admittedly do not see the mixed-skin transplantation as qualitatively comparable replacement for the patient's own skin, but as an important alternative to the methods for replacing skin practised hitherto in cases where the patient has too little skin of his own. Whereas it was hitherto very tedious to produce the mixed skin by hand, it can now be made using a machine, which is not only a help to the surgeon in his race with time, but also contributes to increasing quality. A computer-controlled machine punches holes in the donor skin and fills them with

the skin cells of the patient cultured in the test-tube. 1989, the prototype already proved its prowess at a large fire disaster in the Soviet Union.

Meanwhile, Hettich and his staff are looking into another possibility of providing an effective replacement in burns, which could perhaps become a

rival to mixed skin. Instead of taking the corium of a donor, a membrane taken from an animal's connective-tissue is sprinkled with epithelium-cell islands. The preliminary results are promising; here, too, a durable skin replacement could develop which is accepted by the body.

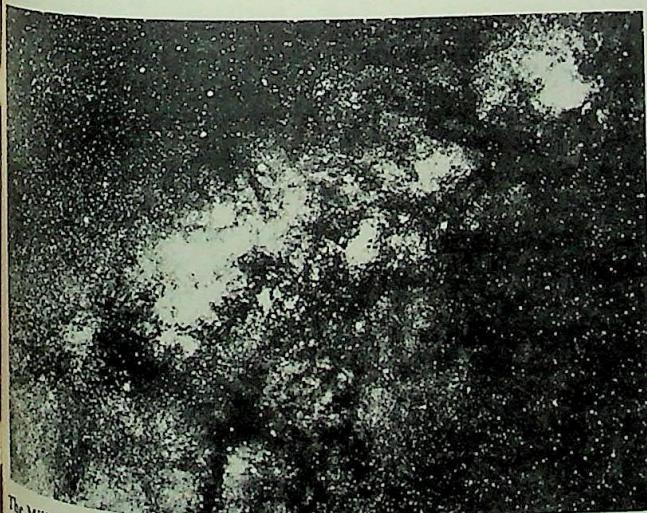
related to the still mysterious centre of the Milky Way, has a temperature of about 2,000 degrees Celsius and "shines" about a hundred thousand times brighter than the sun.

In its proximity, however, the researchers also discovered a cloud of iron steam with a strong electric charge in the form of a markedly curved arc, which, however, can only exist in this physical condition at temperatures of 50,000 degrees Celsius or more. The source of this energy, according to the researchers, could be a black hole of about one million sun masses, an enormously heavy object shrunken to the tiniest dimensions which seizes and devours all matter in its proximity like a huge gravitational whirlpool, with interactions taking place on their "crashing" which release such huge amounts of energy.

Biotechnology

Cooking with Solar Energy

(saw). Energy supply with solar electricity is certainly not only an ecologically beneficial alternative where fossile energy sources such as coal, natural gas, or petroleum are scarce and expensive, but also in warm countries where people might not need to heat, but do have to cook, for instance. For this reason, scientists from the Department of Nuclear and Biotechnology at the Professional School (FHS) of Aix-la-Chapelle have now developed a solar cooker which can be used independently of solar radiation, because it can be used optionally with or without a heat



The Milky Way - what will we find in its centre?

(Photo: Ullstein)

accumulator. It consists of a flat collector with a double-glass top and an accumulator in which the heat-bearing medium, vegetable oil, circulates over stones and is at the same time used to bring the heat from the collector to the cooking surfaces themselves. The minimum radiation required for cooking is about 400 watts per square meter; in periods of

high radiation, the excess heat is fed into the accumulator. The solar cooker has already displayed its prowess in the laboratory and also in a three-week trial in Italy. It was shown that one can cook with it just like on an electric range or gas stove. Moreover, the accumulator capacity would suffice to prepare a meal for a large family even after sundown.

Culture Studies

From the Pilgrimage to Modern Tourism

(df). Modern – and postmodernist – society is regarded as particularly mobile. A change of place for occupational reasons is nothing unusual; travelling businessmen are on the move throughout the world, and during the holidays half of Europe is on the road. Premodern society seems quite immobile by comparison, and indeed, large segments of the rural population never left their village once in their lifetime. Nonetheless, there was a large number of travellers then, too, who, to be sure, often headed for their destinations very much less voluntarily or as part of the problems of making a living. Moreover, not only was the variety of travel greater by far than today, where the colourful folder and catalogue usually only try to create that impression, but also the adventures which today have to be planned for holiday trips, often with great effort, were formerly an almost unavoidable part of the trip.

The close correlation of the development of travel with the economic and cultural requirements of the period in question and the influence of political events on the choice of the destination are described by Hermann Bausinger and Gottfried Korff, professors at the University of Tübingen, and Dr. Klaus Beyer of the German Postal Museum in Frankfurt/Main in the book they edited, "Reisekultur. Von der Pilgerfahrt zum modernen Tourismus" ['The Culture of Travel: from the Pilgrimage to Modern Tourism'] published by C. H. Beck Verlag, Munich.

In it, it is shown that the earliest travellers were the medieval pilgrims who concentrated on nearer destinations. They were followed by the pilgrims who headed for more distant destinations, usually in groups to provide mutual protection. Merchants also travelled through the countryside, as did "surplus" peasant sons looking for work. Otherwise, unless one was a trader or beggar, one preferred to stay at home, disregarding for the moment itinerant performers, cavaliers, and scholars. The cavalier's tour was generally regarded in the 16th and 17th centuries as the

finishing touch to a nobleman's education and as the introduction to the world of European aristocracy. The purpose of scholarly travel was usually research and discovery, further education and the making of contacts.

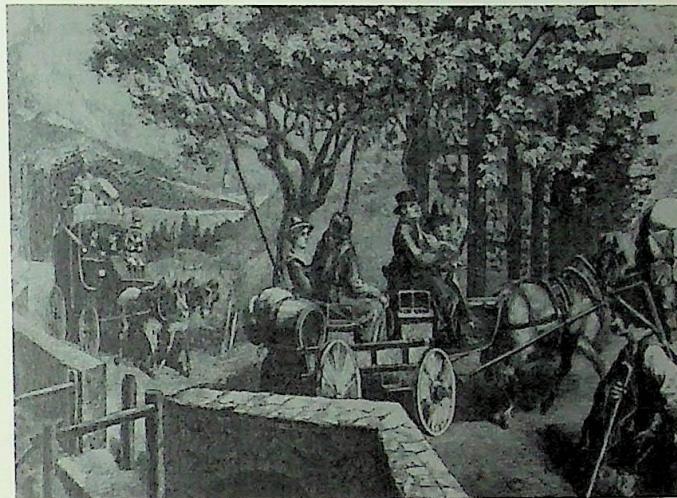
Travel by Post Chaise

Gradually the means of transportation emerged which was to be perfected in the course of centuries: the post chaise. Whereas at the beginning of the "modern era" 40 hours were required to travel the route between Frankfurt and Stuttgart by post chaise, it was somewhat faster in the 19th century with the express coach. When roads were icy or potholed from frost, it was even difficult to keep to the intended "schedule" using fast horses. The post horn, which was first introduced by the Taxis mails, helped to reduce the travel time by a sixth by signalling to notify the next mail station of the imminent arrival of a coach, as Thomas Brune of the Württemberg State Museum in Stuttgart has found. The mails of the Thurn and Taxis company, which at first only conveyed news, also placed horses at travellers' disposal. Usually four or five travellers sat opposite each other on uncushioned wooden seats in the coaches, which were modelled after the rack wagon, with the baggage in the back. Not until 1818 were stagecoaches built on the English model. Passengers coming from far away had to sit in the better seats, although according to Beyer, the tickets were sold regardless of rank and dignity. The horses

pulling force had its limitations, so on difficult mountain roads and in crossing mountain passes up to 40 horses were used, sometimes the passengers had to walk part of the way still themselves, but this was announced before departure. Travel in the winter was more expensive than in the summer because road repairs cost more. People who were in a hurry took the more expensive special mail coach.

Parties of travellers were formed for the purpose of mutual protection against highwaymen and looters. Beyrer reports that the route from Frankfurt to Basle was considered particularly safe. Women often wore men's clothing while travelling, for reasons of security, for example Queen Christina of Sweden or the writer George Sand. But respect for the travelling woman increased at the turn of the 18th to the 19th century. Highly gifted women such as Karoline Schlegel, Henriette Herz, Rachel Varnhagen, or Fanny Mendelssohn broadened their horizon by travelling.

At the time of the French Revolution, many intellectuals were moved to travel there, such as J. H. Campe, who called the revolution "the greatest spiritual good deed since Luther," as Dr. Johannes Weber, a literature scholar at the University of Bremen, reports. But the more bloodthirsty things became in Paris, the more the stream of travellers slowed to a trickle. Not until towards 1830 did artists, scholars, fashion and art enthusiasts again travel to the French metropolis. With the facilities offered by steam-



Broadening one's horizon by travelling... (From: H. Bausinger, Kl. Beyrer, G. Korff [eds.]: Reisekultur. Von der Pilgerfahrt zum modernen Tourismus, p. 68)

ships and later the railroad, travellers' wishes shifted to other destinations. Greece became a popular destination in the first half of the 19th century, as a subject of scholarship, as well, since Winckelmann had rediscovered antiquity. Asia Minor was opened up, as were Sicily and Southern Italy. At the same time, archaeology became a scientific study in its own right, in which the English predominated until the beginning of the Bavarian regency (1832) in the new Kingdom of Greece, which was established after the war of independence against the Turks, whereas due to particularism in Germany, only limited funds had been available for science.

On the road

Amongst the many travellers who were on the road in the 18th century between Paris and Moscow, London, Stockholm, and Rome, the musicians could look back on one of the oldest traditions. Centuries before travel for educational purposes

became a fashion, they had already travelled through Europe and played for burghers and peasants, monks, princes, bishops, and kings. Particularly the nobility was prone to have artists from abroad entertain them. But not until the bourgeois institution of the "public concert" did artistically accomplished musicians have the opportunity of gaining money and fame by travelling. In a way, too, it was at that time that the economic preconditions for concert tours as we know them today came to be. The famous violinist Louis Spohr didn't own a coach of his own. Goethe's travels were documented literally in writings and letters. Spa journeys became fashionable; the whole person was or wanted to be involved and cured at spas. The climate, social contacts, and pleasures attracted many of those who were able to pay for them. Thus, a literature of travel developed which also dealt with financial problems and afforded recreation and excursions.

Ancient-oriental History

Master Farmers Between Euphrates and Tigris

(df). The Bible refers to the Babylonians as a people of petty merchants. Today it is known that the people in the area between the Tigris and Euphrates were engaged in a very highly developed agriculture. With ingenious technology, the farmers of Mesopotamia achieved harvests that were sensational for traditional agriculture. Even in the 16th century, Europe's farmers only harvested a fraction of the amounts a farmer in Mesopotamia achieved 4,000 years ago.

150 years ago, the vanished world of the ancient Orient was re-discovered by European politicians and scholars. It is the region in which the most important phase in the development of mankind took place: a little over 9 000 years ago, hunters and gatherers formed communities of land tillers and livestock keepers. This "Neolithic Revolution," as it is called by experts today, created the

food basis for rapid population growth and subsequently contributed to the development of urban cultures with crafts and long-distance commerce. This historical process peaked in the third millennium B. C. in the city-states of the Sumerians on the middle and lower courses of the Euphrates and Tigris (Babylon).

Even though the Bible and the Israelite prophets only spoke of



The reason for outstanding results of harvest was primarily an ingenious sowing technique. The picture shows a seed plough, a precursor of the modern seed drill. (From: Barthel Hronda, *Der alte Orient, Geschichte und Kultur des alten Vorderasien*, p. 188).

the Mesopotamians with disgust and warned against "Babylon the great, the mother of harlots," the farmers of the ancient Orient proved themselves as true masters of their calling. The feats of civilization of which the Babylonian tillers of the soil were capable are shown in a monumental book by Barthel Hronda entitled "*Der alte Orient*" ("The Ancient Orient," C. Bertelsmann Verlag, Munich).

The Babylonian farmer mainly raised barley, not so much the wheat variant emmer and wheat itself, and he also cultivated the date palm. In addition, figs, pomegranates, and probably apricots came in fresh from the Babylonian countryside. In the texts which have survived, economic plants such as onions, leek, garlic, green vegetables, cucumbers, and legumes are mentioned. In spite of the lack of water and the continuous danger of the soil's becoming salty, the farmers between the Euphrates and Tigris achieved phenomenal harvest yields, which were unique to traditional agriculture. Thus, the yields for barley towards the end of the third millennium B. C. were on the average twenty times and in particularly fertile areas even thirty times the amount of the seed sown. In classical Greece, the ratio was 1:4.5 or 1:7, and in the times of Emperor Nero, the ratio of seed to harvest in Italy was 1:4. At present, the farmers of Normandy (France) achieve twenty times the seed sown, whereas until the beginning of the 15th century the ratio of seed to harvest there was at most 1:3.2. The reason for such outstand-

with dist...
ast "Baby...
other of
of the an-
themselves
air calling
tation of
are shown
book by Bar-
"Der alte
Ort Orient,"
flag, Me-
er mainly
much the
mer and
also culti-
In addi-
ates, and
ne in fresh
a country
which have
plants such
, green ve-
, and leg-
In spite of
the contin-
soil's be-
farmers be-
and Tigris
al harvest
unique to
ire. Thus
y towards
millennium
rage twen-
circularly ter-
times the
sown. In
ratio was
the times of
ratio of seed
was 1:4. At
s of Nor-
e twenty
of the 15c
need to ha-
post 1:3.2.
1 outstan-
g results, which are not
achieved today in many farm-
areas of the Orient and
North Africa, was primarily an
ingenious sowing technique
which permitted the farmers to
use the seed extremely economi-
cally. With the seed plough, a
precursor of the modern seed
drill, the farmer of Mesopota-
mia could insert the seeds equi-
stantly in the furrow, so that
the young plants could ripen
under optimum conditions.
Moreover, the furrows were

50 to 75 centimeters apart.
The importance attached to
agriculture by the people of
Mesopotamia is recorded in nu-
merous administrative docu-
ments regarding expected
yields and amounts harvested.
Agricultural technology was
also correspondingly devel-
oped there: it even reached the
extreme that the farmers on the
Euphrates and Tigris hitched
special cattle to the seed plough
which had been expressly
trained for the task of sowing.

Neurology

Missing Parts of the Body Are Still Perceptible as Phantoms

(df). Amongst the spookiest things a person can ever experience in his life is what is called the "phantom sensation": parts of the body which have been lost due to injury are vividly recalled to consciousness. According to recent research results, these hallucinatory impressions, which are often very painful, occur at the nerve circuits which are also the seat of the "body ego."

In nearly all arm and leg amputations, phantom sensations can be observed immediately after the operation; sometimes they persist undiminished for decades. The removed extremities the furthest away from the trunk do the most mischief. This is probably because the fingers and toes are represented in the sphere of the brain responsible for somatic sensations by a particularly fine network, Professors Erich Lorenzoni and Bernd Frank of the Hannover Medical School explain in "Fortschritte der Neurologie und Psychiatrie" [Advances in Neurology and Psychiatry] (vol. 60). The affected patients not only retain the normal feeling of still having the lost extremity, they even have a sensation of pathological changes such as sores or scars which were there before the operation.

As the source of these phantom sensations is largely unknown, there are also no clear guidelines for therapy. At present a

Unknown Kant Letter Discovered

Of unique significance, in the opinion of experts, is a letter by the German philosopher Emmanuel Kant (1724 to 1804), which the Düsseldorf scholar Dr. Günther Baum discovered while engaged in research of literary sources. The letter, dated October 31, 1794, is addressed to Kant's pupil Friedrich August Nitsch, who was giving lectures on Kant's philosophy in England at the time. Kant, by this time already 70 years old, gives his pupil didactic advice "on the outline of the lectures" and to this end summarizes the principles and results of his philosophy.

Historical Rarity

Baum found the historical rarity, which is a valuable addition to the very few Kant manuscripts which are available to scholars in archives and libraries throughout the world, while conducting research on the life and works of the Düsseldorf philosopher and writer Friedrich Heinrich Jacobi (1743 to 1819)—a project which



Kant take a stroll; drawing, c. 1798.
(Photo: Archiv für Kunst und
Geschichte)

is part of the series "Personalities of the Region" sponsored by the North Rhine-Westphalian Ministry of Science and Research.

Already in 1986 Baum had come across a manuscript of Kant's: the until then inaccessible first four manuscript pages of the essay "On Eternal Peace."

broad spectrum of methods is being tested, amongst which are electric nerve stimulation, ultrasound, biofeedback, and a variety of analgesic and psycho-pharmacological drugs. Success has (as yet) been spotty and much dependent on the patient's personal constitution. The oldest explanation for phantom sensations was based on the assumption that the severed nerve fibres, which grow together at the stump and form neuromas, go on producing impulses, sending them to the sensitive regions in the brain, writes the Canadian psychologist Ronald Melzack in "Scientific American" (no. 4, 1992). Therefore these fibres were lopped off directly above the neuroma or at the transition point to the spinal cord, to combat the pain at its root. But this operation brought some relief only for a few months or years; it didn't get rid of the imaginary extremity once and for all.

Other experts believe that the perceptive nerve cells in the spinal cord are misguided and send off a "barrage" towards the brain when they are cut off from the area they receive stimuli from. But that can't be the whole story, either, as paraplegics sometimes have irritating pains in the abdomen, even though the conduction paths in the spinal cord are dead.

Melzack concludes from his results that phantom sensations are "yarns off the top of the head," in the phrase's most literal sense. According to this explanation, stimuli from all parts of the body empty into an intricate network of nerve cells under the cranium, the neuro-matrix. This structure in turn constantly produces a characteristic space/time-encoded stimulation pattern, a neurosignature. The subjective sensation is that the body is in order and is the seat of one's own identity. The nucleus of this "body ego"

consists of the classical somato-sensory paths which transport information on body sensations and bring it by way of the thalamus (the main part of the diencephalon) to the somatosensory cortex. But the limbic system, which is concerned with the emotional side of stimuli, and the parietal lobe, which is responsible for the feeling of identity, are also involved in the system. The "body ego" seems to be innate in essence. Melzack found some people who had vivid phantom sensations although they had been born without arms and legs. Animal experiments have already confirmed the suspicion that the neuro-matrix produces wild ultrarapid impulses if it is not supplied with signals from the body. And the animals are relieved of the phantom-like pains if their limbic system is anaesthetized. Hopefully patients will soon profit from the new findings.

Preview

The next issue of UNIVERSITAS
will presumably contain the following contributions:

The History of Utopian Thought

Political Utopia or

**The Contemporary Relevance of the Idea
of Possibility**

Frank R. Pfetsch, Heidelberg

Political Science

Utopia and Human Rights

Richard Saage, Halle (Saale)

Philosophie of Science

Order into Chaos?

How Scientific Knowledge Shapes our

World View

Gerhard Vollmer, Braunschweig

Chaos and Complexity

Self-Organization in Complex System

Bernulf Kanitscheider, Gießen

Ecology

Ecological Sins, Dilemmas and Social Traps

Hans Lenk, Karlsruhe

Aesthetics

The Dictatorship of the Right Angle

The Geometrification of Our Realities

Hans-Peter Schwöbel, Mannheim

Economy

Prices Should Tell the Truth

Ernst Ulrich von Weizsäcker, Bonn

Political Utopia or The Contemporary Relevance of the Idea of Possibility

Frank R. Pfetsch, Heidelberg

Nothing is sadder than the death of an illusion, as Arthur Koestler remarked when he rejected Stalinism during the thirties, and it appears that the revolutionary changes in Eastern Europe have caused many people to abandon their illusions. The failure of the painful "experiment of real existing socialism" also seems to have been the death of a utopia or, more precisely, the failure of the inherent ideals of socialism.

What failed, however, is not the utopia itself – this, as we shall see, cannot fail – but rather the attempt to realise it ideologically and politically. Utopias only include the hope that they will be realised; they do not constitute the realisation itself. Utopia became a prisoner of ideology.

The Temporal Dimension

The social changes in Eastern Europe were the counterpart of the failed social experiments which were based on closed national plans and thus neglected the social basis demanded by Marx. They were social mass movements with neither a utopian nor an ideological foundation and were influenced by ideals already existing in certain societies. Contrary to the claim of the Polish philosopher Leszek Kolakowski that no social mass move-

ment to date has succeeded without a utopian or mythological basis¹, these peaceful revolutions were in fact practical movements against regimes and were oriented towards existing alternatives.

The following attempt to define the utopian concept as it developed throughout the history of utopian thought² tries to clarify the polarity of plan and reality

Prof. Dr. Frank R. Pfetsch was born in Karlsruhe in 1936 and studied Economics and Politics. He received his PhD and did his postdoctoral research ("Habilitation") at the University of Heidelberg. He worked in research institutes and

in the former Federal Ministry for Scientific Research. As adviser to the UNESCO, he worked internationally in the areas of science policy and research planning. In 1976, he became Professor of Political Science at Heidelberg University. He was a guest professor at the University of Pittsburgh, the Kyung Hee University Seoul and was also based at Leipzig University. He has published widely on science policies, foreign relations, international affairs, and constitutional politics.

Prof. Dr. Frank R. Pfetsch, Institut für Politische Wissenschaft, Universität Heidelberg, Marstallstrasse 6, D-6900 Heidelberg 1



and to defend the concept against the claim that it failed.

Which Characteristics Constitute Utopias?

1. Utopias are mental sketches, i. e. concepts of a better or worse world formed by the ratio. Robert Owen speaks of a "rational system of society". The term 'dream' which denotes an unconscious entity does not include the rational core of the utopian enterprise. Daydreams "privately paint conscious situations, images of a desired, seemingly better world".³ The expression 'rational world shaping plan', coined by Lothar Bossle, does not cover the essential characteristic of pure utopias. The concept 'plan' indicates that the most important factor is the realisation or change for the better, hence the term 'plan for the world's salvation'.

2. Utopias do not comprise empirical or rational interpretations of existing social conditions. They are alternative realities, abstract mental ideals depicted in a concrete fashion and do not provide for any real transition to experienced reality. Thus Lars Gustafsson, in his book "Utopias", speaks of a 'discontinuous transition' because it is hardly possible to imagine utopias which provide for a gradual transition from one existing society to another. Hence utopias are simply described as beginnings.

3. Utopias are alternative or counter realities and cannot be found in real life. In the words of the novelist Robert Musil, the sense of possibility is the opposite of the sense of reality.⁴ The utopians' reality transcends all normal ideas; utopias are distant objects in both a spatial and a temporal sense.

4. Utopias have been devised without the intention of seeing their ideals realised

(This is the difference between utopia and planning or simulation), although some authors might have wished to see their intentions realised. Robert Owen's "New Harmony", for example, did exist for a short while in Pennsylvania. Similarly, Fourier's Phalansterium was tried out in Texas, and Jesuits attempted to realise Campanella's Sun State in Paraguay. But all these experiments failed, even if this did not prevent other attempts at realising utopias being made.

5. Utopias must be seen on two different levels. On the one hand, they involve criticism of the existing reality and thus concern the present (system immanent criticism). On the other hand, they are set in an unreal sphere which does not really exist (system transcending criticism). The future becomes the negation of the present. The fact that utopias are thus removed from reality makes it easier for their opponents to denounce utopian authors as dreamers and madmen who cannot be taken seriously. Almost all intentions directed towards the future are thus regarded as essentially incapable of realisation. However, it has often happened that today's utopias have become tomorrow's realities. Revolutionary zest includes the impossible in the present reality and regards the utopian as being present. This is also indicated by slogans like 'Le rêve est réalité' (French student movement 1968) or 'Be realists and demand the impossible' (German student movement 1968).

6. Utopias consciously transcend space and time. Their settings are artificial constructs (islands, planets etc.). They take place in the future (Orwell's "1984") or are seen from a future perspective (Bellamy's "Looking Backward: 2000 - 1887"). Fictitious communities are discovered as a result of adventurous journeys; typical

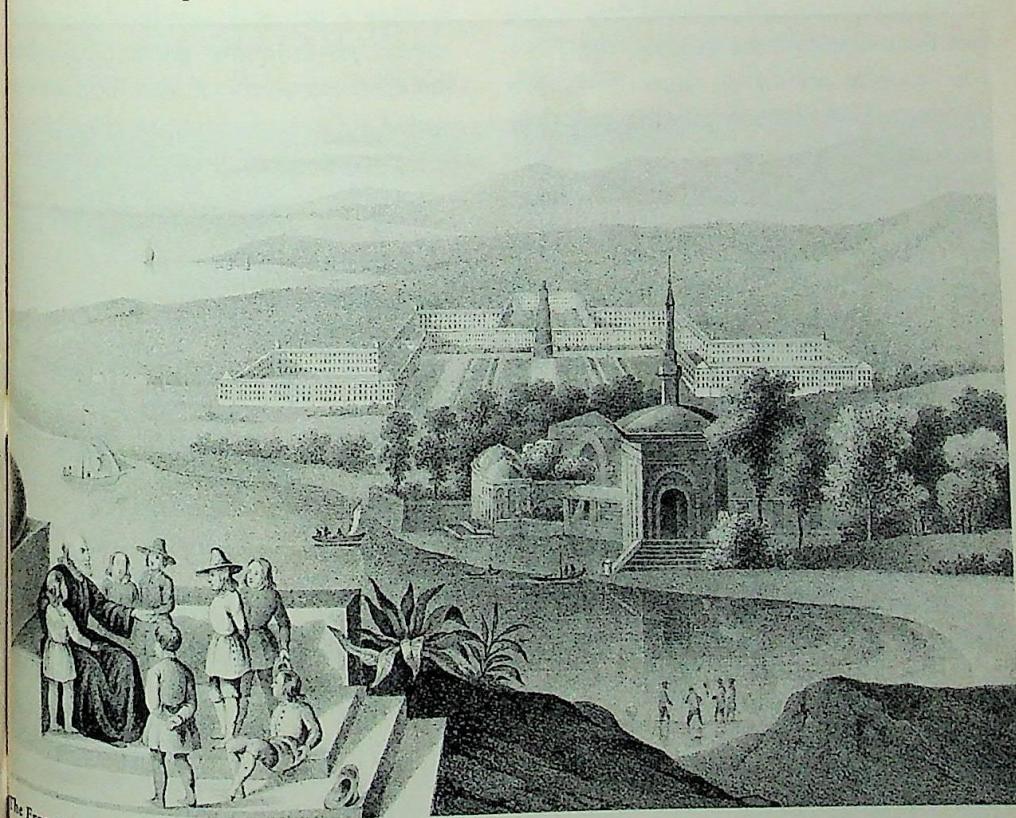
scenarios are shipwrecks followed by running aground on an unknown island, expeditions to an unexplored country, dreams and space missions.

7. Utopias are sparked off by crises.⁵ Plato draws up his Dorian ideal Republic in contrast to the war-torn Greek polis of his time. More's Utopia is written as an alternative to the "wretched need and misery" of the farmers who lost their land through enclosures. Andreae's 'Christianopolis' was provoked by "the dominance of tyranny, sophistry and hypocrisy". Owen contrasts his contemporary world of "ignorance and selfishness" with a new moral world in which "truth alone will govern... (and) knowledge, unchecked by superstition or prejudice".⁶ Like other utopian early socialists, he hoped that associative small experiments would re-

move social injustices resulting from the early capitalist means of production. Bellamy wrote at the time of the "great upheaval" in America, Hertzka during the Great Depression in Germany.

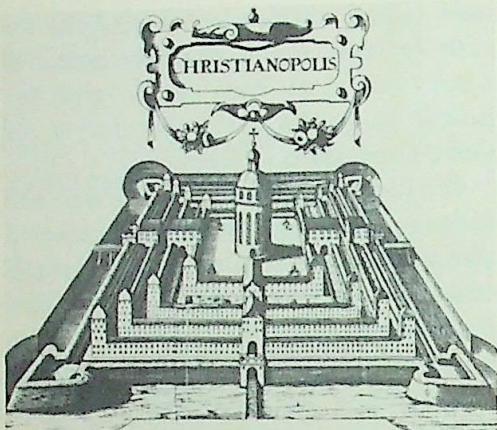
For Samjatin, Huxley and Orwell and their negative utopias telling of numbered and standardised human beings the totalitarian political systems of Bolshevism and Fascism serve as foils. And the modern ecological and feminist utopias by Gilman, Atwood, Lessing or Callenbach and Thompson confront the modern-day technical civilisation which threatens not only the environment but also mankind itself. Crisis however cannot be considered an exclusive criterium, because this consciousness can be found everywhere in existing societies.

8. Utopias do not have a reforming ef-



The French social philosopher Charles Fourier (1772 to 1837) developed the utopian idea of "Phalanstères", autonomous co-operatives constituting the state. Anonymous Lithograph.

(Photo: Archiv für Kunst und Geschichte)



Bird's eye view of Christianopolis; copperplate engraving.

fect, they are not concerned with pragmatic small steps but with the totality of things. They do not indicate how they can be realised nor how the ideal way of life can be attained. "Pure utopias" are therefore socially and, even more, politically deficient. They are all but systems of action, although they may have been understood as such and become historically effective at a later date. This characterisation deals with the genesis of utopias which must be distinguished from their effect.

9. Utopias are rooted in a particular time, even if the ideal is projected into the future and has an invented setting. "A utopia is not simply a suggestion", Gustafsson writes. "By way of contrast, it is also a picture of the existing society."

10. Utopias are comprehensive designs, or as their critics say, totalitarian thought systems.⁸ They are closed, static, rationalistic and have no concept of action or inherent component of change. The utopian design is complete in two ways. Firstly, because it covers all areas of life and secondly, because it determines and controls all types of behaviour. For many au-

thors hierarchic structures determine what happens in the community. Thus totality is an essential characteristic of "pure utopias".

Because of these structural components, utopias can be compared with Leftist totalitarianisms (Stalinism). Their cognitive basis, on the other hand, means that they are also comparable to democratic approaches which are rationalistic in character. (Talmon: "totalitarian democracy"). The opposite of the rationalistic approach is the empirical view of democracy (Sartori) which reaches decisions by trial and error rather than by set plans.⁹

11. Utopias are imaginable worlds, better or worse (the latter functions as a deterrent). The bad serves as a contrast for the good. The writer's intention when writing a negative utopia is thus also directed towards the good. Jürgen Rühle speaks pertinently of the "optimistic tragedy".¹⁰ The prevention of the negative is intended to bring about the positive; thus the distinction between positive and negative concerns the form rather than the actual intention. This dialectic is often a result of the lives of the utopian authors. "The outline of a better world is accompanied by the negative lives of the authors" as Auguste Comte remarked.

12. Utopias are directed towards new ideas and a new way of thinking. Many technical and social innovations contained in utopian descriptions have materialised at a later date in a positive or negative fashion. Utopias are thus early recognition or early warning systems. They anticipate realities and reveal future social tendencies.¹¹ More sees the free type of market, Campanella the absolute period of manufacturing, Bacon and Andreae outline the future scientific society at a time when superstition, medi-

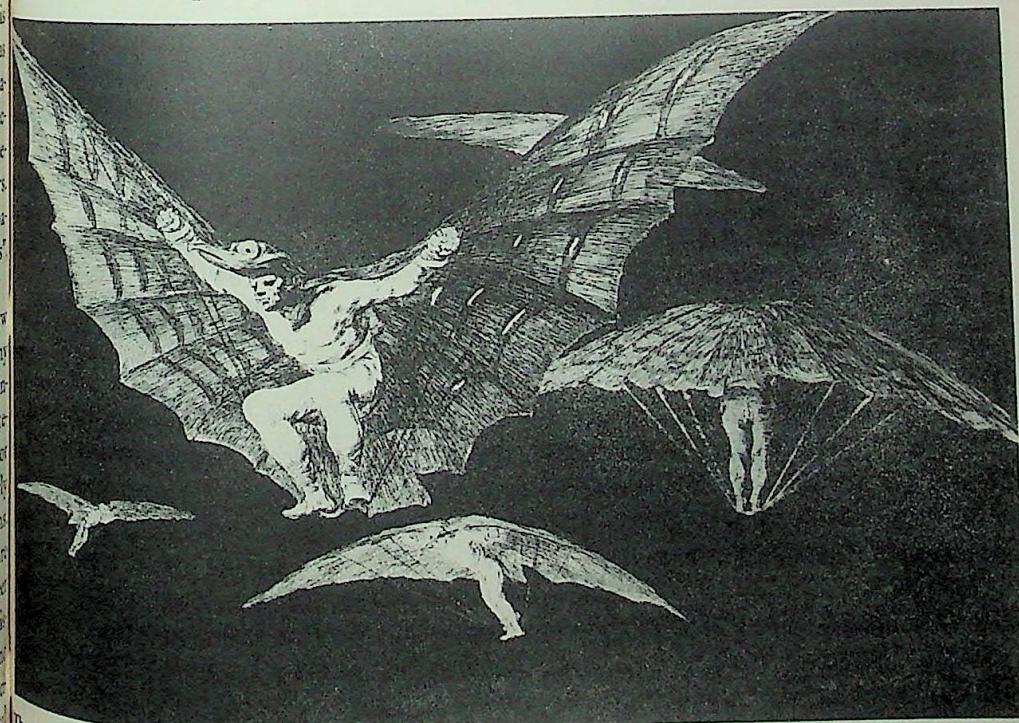
chemistry and ecclesiastical dogmatism dominated intellectual life. Three hundred years later Saint-Simon thought with fascination "de l'industrie". Some suggestions, particularly regarding educational systems, only gained recognition in the twentieth century: an obligatory school system is demanded by utopian thinkers at an early stage. Discoveries are thought.

early modern utopians consider genetic engineering of model human beings; Campanella devises the art of flying; telescopes and ear trumpets are being invented; a type of propeller powers mail order firm and music transmission worlds, before radio). In the age of Absolutism the utopias as a dreams of the early modern age and of the contrast for Enlightenment are familiar with the idea on when public meetings.

Science fiction, the technical branch of utopian literary genre, deals specifically with technical possibilities. Negative

utopias, however, also abound with descriptions of negative technology, for example that used for complete supervision and manipulation. The breeding of human beings by specific selection becomes possible. In more recent utopias, medicine is used to put people into a certain state of mind and make them easier to control.

13. It can generally be said that the majority of utopian authors are social outcasts and non-conformists. In this they are similar to innovators who from their very situation on the fringe of society develop original ideas, just because they do not conform with the prevailing conventions. More and Münzer end on the scaffold; Campanella spends 27 years in prison; Fourier is full of quaint and whimsical habits; Owen experiments incessantly and risks losing all his possessions; Huxley and Orwell both lead an extraordinary life.



The dream of flying – expressed by Francisco Goya (1746 to 1828).

(Photo: Archiv für Kunst und Geschichte)

14. It is possible to trace a coherent sequence of literary outputs through time. More's, Campanella's and Andreae's early modern utopias take up ideas from Plato's Republic. Similarly, the utopians of the Enlightenment and Early Socialism refer to their respective predecessors.¹² This continuity can be traced to the present day and is the common element in all utopian literature.

15. If we trace the concept of utopia through time, we cannot but discover a change in meaning. While older definitions give a positive picture of the imagined ideal in an invented setting — "the Land of Cockayne definition" — later attempts at definitions are supplemented by "negative ideals".¹³ While the authors of earlier utopias aimed at describing a beautiful and desirable life, deterrent, even horror utopias seem predominant today. This becomes even more accentuated if it can be shown (a) that older utopias do not in fact depict ideal conditions when seen from a modern point of view, and (b) that earlier descriptions of ideal worlds always had their negative foil which contrasted with their positive elements.

Thus negative utopias are also oriented towards a better world; by warning the reader, they fulfil a preventive function. It is imperative that the negative world does not materialise.

Typologies

The different types of utopias can be divided according to different aspects. Of the many definitions, however, only the following two typologies are meaningful and convincing because they can be historically placed.

Spatial and Temporal Utopias

This distinction concerns the spatial or temporal dimension. Until the nineteenth century, utopias take place contemporaneously, but in a different place. The modern "temporalisation of history" (Verzeitlichung der Geschichte [Reinhart Kosellek]), however, and the replacement of the feudal order based on class and status by function-oriented societies, as well as the completion of the discovery of the remotest parts of the earth, all lead, more and more, to an eclipse of spatial utopias. Utopias set in the future or looking back from the future now replace spatial island utopias. By the end of the eighteenth century, temporal utopias begin to take over from spatial utopias.

Positive and Negative Utopias

This distinction concerns the extent to which the ideal is desirable, i. e. whether it is positive and desired or negative and feared. Norbert Elias distinguishes utopias characterised by fear and those characterised by longing. The transition from positive to negative utopias occurred at the turn of the century, during the "fin-de-siècle atmosphere". Cultural pessimism and resignation find expression in Donnelly's division of society into the ultra-civilised rich on the one hand and the poor masses who have no rights on the other. Jerome K. Jerome uses the picture of human beings with the "expressions of horses and oxes" to depict a totally uniform society in "The New Utopia" (1981). Jevgenij Samjatin's novel "We", written after the First World War, could be termed the first real negative utopia. Negative experiences during the Russian Revolution bring about a new type of utopian literature. The wish for a

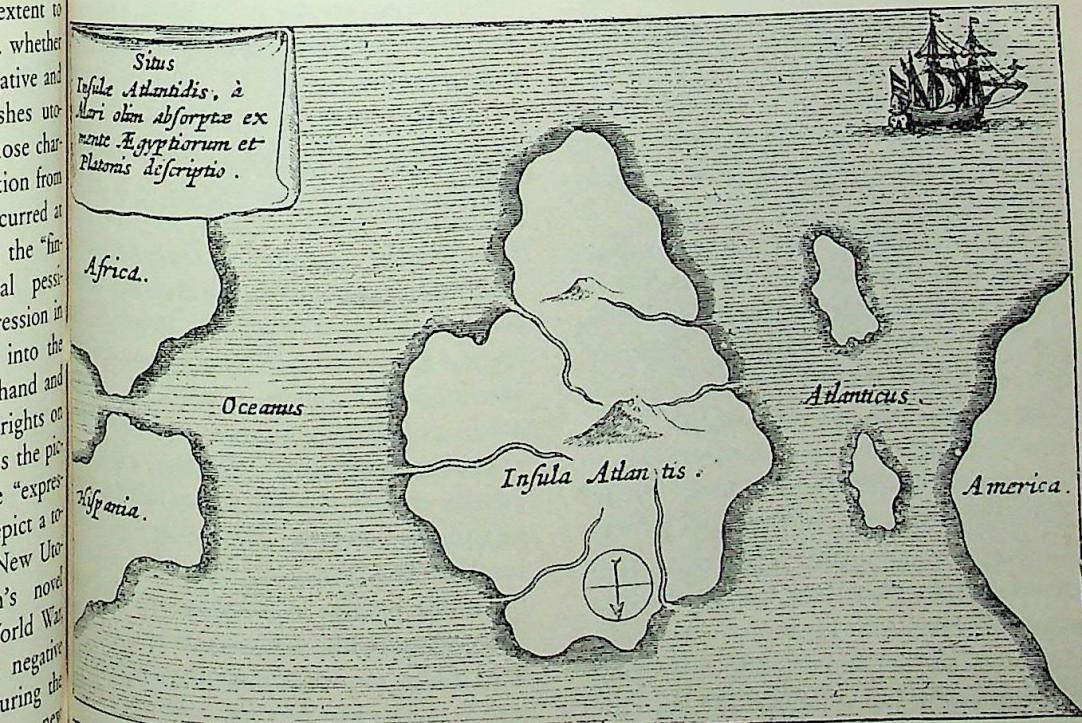
better world no longer finds expression in the depiction of an ideal world, but in the depiction of horror which, it is hoped, would act as a deterrent. Certain unpleasant contemporary developments are thus made absolute and portrayed in a negative light.

The dichotomous typologies just mentioned can be ordered chronologically. Until the eighteenth century, utopian literature is dominated by positive spatial utopias. Towards the end of the eighteenth century, positive temporal utopias begin to take shape. Negative utopias are indisputably the prevailing model in this century. The stages in the development of utopian literature which we have now examined correspond with real historical developments. Positive spatial utopias emerge during the atmosphere of change in the Renaissance and Humanist Enlightenment and capture the general

curiosity of the time regarding new, unknown parts of the world. With the discovery of the remotest parts of the world, utopias then are transferred to an unknown future. In this century, finally, negative experiences with totalitarian systems and technical scientific 'achievements' give rise to negative utopias with both temporal and spatial settings.

Criticism of Utopias – The Political Usurpation of the Utopian Concept

At the beginning of the eighteenth century, Bernard de Mandeville, a Dutch doctor living in England, sarcastically criticises the utopians' ideal worlds. Against the premise of all utopians – "chaste masses", "free from all dirt and defilement" (Bacon) – he argues that it is not



The legendary island of Atlantis – referred to by Plato in his Dialogues 'Kritias' and 'Timaios'.

(Photo: Archiv für Kunst und Geschichte)

the good person but the vicious and egoistical who contributes to the well-being of all. Indeed the worst and most detestable human characteristics, desires and passions enable us to form happy and successful communities. "Pride, luxury and deception/are necessary for the well-being of a people" and "in large states there is little room for virtue".¹⁴

The famous dictum "private vices public benefits" in Mandeville's fable of the bees sums up the main principle of the existing early capitalist economy and anticipates Adam Smith's theory: everyone contributes to the prosperity of the nations by following his egoistical pursuit of profit. If, on the other hand, everyone is good, the economy collapses. In utopian worlds the needs of the people are reduced and the economy stagnates. In the contrasting model where the people are full of vice and dominated by their physical urges, growth and prosperity, however distributed, occur. Mandeville turns the positive utopias upside down: for him the idea of virtuous and honest human beings is utopia: "The idea of a human being free from vice will always be utopian."

And in another respect Mandeville is also ahead of his time. He realises that everyone tries to hide egotistical desires by using pleasant sounding common phrases. Thus doctors are said to serve the good of mankind when in fact they're only earning their living; lawyers claim to be working in the cause of justice even if that only means earning high fees by solving disputes; ministers are supposed to be serving the King even if they only pursue their own profit, etc.

Present day understanding and assessment of utopias is influenced by the experience that certain utopias which were considered purely hypothetical have ac-

tually materialised in this century. The communist ideal of a community of equals and the national socialist ideal of a national community of race and blood resulted in horrifying totalitarian systems when they became political realities. The combination of utopia and ideology (concrete utopia) in these "experiments" brought about this century's greatest catastrophes. "Utopia as a driving force behind thought and action can have positive as well as negative results."¹⁵

Against this background it can be said that the assessment of utopian systems greatly depends on the prevailing political outlook. It can generally be said that the more right-wing the outlook, the more negative the judgement will be; and the more left-wing, the more positive it will be. This is connected with the fact that utopias concern something that doesn't exist and thus indicate change. Conservative thought, on the other hand, is deeply rooted in the status quo and shies away from change.

Pleading for Utopia, or: How can Utopias be Justified?

The polemic treatment of the opponent's position does not alter the fact that all political ideologies contain utopian elements. This is as true for the conservative idea of a hierarchical order and technocratic necessity as it is for the socialist idea of a community characterised by solidarity or the liberal idea of a harmonious market society. Thus every position can be accused of being utopian, and utopia is the perfect political clout when arguing against one's opponents.

In order to avoid this instrumentalisation it is necessary to argue for the "pure" concept of utopia, i. e. for a concept which does not include any plans for its

realisation, as such plans will always combine utopian with ideological and even religious systems.

According to this view, utopias are not outlines of future salvation or closed ideologies. They are not ideals demanding realisation, nor are they assessments of what is feasible, limited to contemporary existing social structures. Their essential characteristic is the concept of a possible world in which different hypotheses can be tried out. Thus the utopian concept is preserved in its pure form and is not instrumentalised for any ideological purpose. Applied to practical politics this means that utopias can and should be seen simply as mental extensions which enrich day-to-day affairs without becoming a practical model for political action.

Finally, we have to ask what utopian thought and utopian literature have produced. What is – again and again, but perhaps more than ever in our present age – the motivation behind utopian thought?

One answer is immediately obvious. Scientific analysis which is continually advancing and becoming more and more specialised is being met by a growing need for synthesis and unity. The demand for this pendant seems to correspond with a basic human condition. The myth of origin as a means of returning to the pure beginnings of life, and the total plan for a social order set in a utopian future which has yet to be realised: both can be seen as expressions of holistic thought.

An additional aspect is that the need to play and fantasise is another essential element of human nature. If what is imagined does not become reality it is given expression in an (initially) utopian postulate, in a kind of substitute terrain.

The history of utopian thought is a history of protest. The contemporary world

from which utopias emerge is considered inadequate and these deficiencies are met by the description of more beautiful worlds. Utopian history is thus an alternative history which has always paralleled real history. "All historical experience shows that the possible would never have been attained if people hadn't repeatedly sought the impossible."¹⁶ Or, as Oscar Wilde put it, "A map of the world that does not include Utopia is not worth even glancing at."

English translation by
Mary Ann Kenny and Eberhard Bort

¹ See.: *Kolakowski, L., Marxism – Utopia and Antitopia (Marxismus – Utopie und Antitopie)*, Stuttgart 1974. – ² For an introductory survey of concepts and discussions of utopia see *Biesterfeld, W., The Literary Utopia (Die literarische Utopie)*, 2nd ed., Stuttgart 1982; see also *Baumer, Fr., Future Paradises. Human Dreams of a Better Life (Paradiese der Zukunft. Die Menschheitsträume vom besseren Leben)*, Frankfurt 1967; *Bloch, E., The Principle of Hope (Das Prinzip Hoffnung)*, Frankfurt 1959; *Bloch, E., Freedom and Order. An Abstract of Social Utopias (Freiheit und Ordnung. Abriss der Sozialutopien)*, Frankfurt 1986; *Bloch, E., The Utopian Idea (Geist der Utopie)*, rev. ed., Frankfurt 1985; *Engels, Fr., The Development of Socialism from Utopia to Science (Die Entwicklung des Sozialismus von der Utopie zur Wissenschaft)*, in: *Marx/Engels, Selected Writings II (Ausgewählte Schriften II)*, Berlin (Ost) 1958; *Frei, B., On Social Utopia (Zur Kritik der Sozialutopie)*, Frankfurt 1973; *Freyer, H., The Political Island. A History of Utopias from Plato to the Present Time (Die politische Insel. Eine Geschichte der Utopien von Platon bis zur Gegenwart)*, Leipzig 1936; *Geoghegan, V., Utopianism and Marxism*, London, New York 1987; *Hermand, J., Somewhere. Forms of Utopian Thought (Irgendwo. Formen utopischen Denkens)*, Königstein/Ts. 1981; *Kraus, W. (ed.), Journey to Utopia. Three Centuries of French Utopias (Reise nach Utopia. Französische Utopien aus drei Jahrhunderten)*, Hamburg 1964; *Krysmanski, H.-J., The Utopian Method (Die utopische Methode)*, Köln, Opladen 1963; *Kumar, K., Utopia and Anti-Utopia in Modern Times*, Oxford, New York 1987; *Mannheim, K., Ideology and Utopia (1919) (Ideologie und Utopie [1919])*, Frankfurt 1987; *Mähl, H.-J., Philosophical Chiliasm (Philosophische Chiliasm)* (Philoso-

phischer Chiliasmus), in: Vietta, S. (ed.), *The Literature of the Early Romantic Period (Die literarische Frühromantik)*, Göttingen 1983; *Manuel, F. E.-/Manuel, F. P.*, *Utopian Thought in the Western World*, Cambridge (Mass.) 1979; *Neusiiss, A. (ed.)*, *Utopia. Utopian Concept and Phenomenon (Utopie. Begriff und Phänomen des Utopischen)*, Frankfurt 1968; *Seibt, F.*, *Utopica. Models of Total Social Planning (Utopica. Modelle totaler Sozialplanung)*, Düsseldorf 1972; *Servier, J.*, *The Dream of the Great Harmony. A History of Utopia (Der Traum von der großen Harmonie. Eine Geschichte der Utopie)*, München 1971; *Swoboda, H.*, *Utopia. The History of the Disire for a Better World (Utopia. Geschichte der Sehnsucht nach einer besseren Welt)*, Wien 1972; *Swoboda, H. (ed.)*, *The Dream of the Best State. Texts from Utopias from Plato to Morris (Der Traum vom besten Staat. Texte aus Utopien von Platon bis Morris)*, München 1972; *Voßkamp, W. (ed.)*, *Utopia – Research (Utopie-Forschung)*, 3 vols., Frankfurt 1985. 6X. — ³ *Bloch, E.*, *Tübingen Introduction to Philosophy I (Tübinger Einleitung in die Philosophie I)*, 2nd ed., Frankfurt 1964, p. 124. — ⁴ See *Musil, R.*, *The Man Without Qualities (Der Mann ohne Eigenschaften)*, Hamburg 1970, pp. 16, 246, 248. — ⁵ See *Nipperdey, Th.*, *The Function of Utopia in the Political Thought of Modern Time (Die Funktion der Utopie im politischen Denken der Neuzeit)*, in: *Archive of Cultural History (Archiv für Kulturgeschichte)* 44 (1962), pp. 357–378. — ⁶ *Owen, R.*, *The Book of the New Moral World*, London 1882, Part I, p. xvii. — ⁷ *Gustafsson, L.*, *Utopias (Utopien)*, Frankfurt, Berlin, Wien 1985, p. 87. — ⁸ See *Popper, K. R.*, *Plato's Magic as an Example of the Second, Worse Error (Der Zauber Platons als Beispiel des zweiten, schlimmeren Irrtums) in Gnomon* 39 (1937), pp. 6–13. — ⁹ See *Talmon, J. L.*, *The Origins of Totalitarian Democracy (Die Ursprünge der totalitären Demokratie)*, Köln, Opladen 1961;

Sartori, G., *Democratic Theory*, New York 1967. — ¹⁰ *Rüble, J.*, Afterword to *Samjatin's novel We (Nachwort zu Samjatins Roman "Wir")*, 1984, p. 221. — ¹¹ See *Bloch, E.*, (Note Nr. 3), p. 130. — ¹² See *Saage, R.*, *Thinking in Terms of Contracts and Utopia (Vertragsdenken und Utopia)*, Frankfurt 1989. — ¹³ Meyer's *Konversationslexikon* of 1871 defines the term "Utopia" as follows: Nowhere, the fantastical island where Thomas More's state was set, the German Land of Cockayne (Schlaraffenland) where the best pleasures can be had without the slightest exertion. Towards the end of the eighteenth century the Austrian general Schrebelin drew up a humorous map under the title "Tabula Utopiae" or "The Land of Cockayne", which was at its time considered an excellent satire. Thus the definition of a utopian is someone who expects everything without having to work for it. The *Neue Brockhaus* (1960) defines "Utopia" as the description of an imagined (desired or feared) state of society; from the start, mostly an ideal state of society, as in Thomas More's novel "Utopia" (1516) which gave the genre its name. According to the latest edition of *Wahrig* (1988) utopias are "descriptions of a future state of society, usually hoped for, but sometimes also feared; generally speaking: a wishful dream, a figment of imagination, a fantasy. Duden defines: Utopia, gr. ou = no, not; topos = place, thus no-place, nowhere, a land or area that does not really exist, a place that only exists in the imagination, and where there is an ideal state of society. — ¹⁴ *Mandeville, B. de*, *The fable of the bees or private vices public benefits (1705)*, German ed., edited and introduced by Walter Euchner (*Die Bienenfabel*), Frankfurt 1980. — ¹⁵ *Lompe, K. L.*, *Academic Political Advice (Wissenschaftliche Beratung der Politik)*, Göttingen 1966, p. 71. — ¹⁶ *Weber, M.*, *Politics as Profession (Politik als Beruf)*, in: *Collected Writings (Gesammelte Schriften)*, Tübingen 1958, p. 185.

Utopia and Human Rights

Richard Saage, Halle (Saale)

more than ever before, fundamental individual and human rights are today the lasting legacy of the Enlightenment. But within the tradition of enlightened thought since the early modern era, their role in the classical debate on the great utopias has been difficult from the beginning. How do the historic dimensions and the current significance of these two competing attempts at creating humane living conditions for all appear to us today?

The 34 CSCE states adopted a "Charter for a New Europe" at their Paris summit in November, 1990. The historic significance of this event is undisputed: for the first time in history, the "unswerving loyalty to a democracy based on human rights and fundamental freedoms"¹ was declared to be the central tenet of a new pan-European identity.

The social and historic point of departure of modern human rights, like that of the political utopias of the modern era, was the decaying order in the medieval feudal system. The dimensions of this collapse cannot be pictured drastically enough: it ranges from the radical impeachment of the scholastic leges hierarchy to the dissolution of a social structure in which religion, politics, economics, culture, law, and social stratification were fused together to form a hierarchical

whole. What once seemed to be more or less cosmically established as a unity, now began to be differentiated in its various elements in a long-drawn-out and crisis-ridden process. Increasingly, politics, economics, religion, learning, law, art, etc. displayed the tendency to constitute autonomous spheres. This development did

Professor Richard Saage, born in 1941, is a political scientist at the Political-science Institute of the Martin Luther University of Halle-Wittenberg. His main fields of research are the history of political ideas, utopia



research, history of the labour movement, Fascism and conservatism. His publications include: "Faschismustheorien" ("Theories of Fascism"), 3rd ed., Munich, 1981; "Rückkehr zum starken Staat?" ("Return to the Powerful State?"), Frankfurt, 1983; "Arbeiterbewegung, Faschismus, Neokonservatismus" ("The Labour Movement, Fascism, Neoconservatism"), Frankfurt, 1987; "Vertragsdenken und Utopie" ("Contract Theories and Utopia"), Frankfurt, 1989; "Das Ende der politischen Utopie?" ("The End of Political Utopia?"), Frankfurt, 1990; "Politische Utopien der Neuzeit" ("Political Utopias of the Modern Era"), Darmstadt, 1991.

Prof. Dr. Richard Saage, Dohnenstieg 6,
D-1000 Berlin 33

not stop at the role of the individual: due to the steady process of the dissolution of traditional ties, he found that he had to rely on himself. As long as this state of affairs lasted without offering any perspective of a new orientation, the crisis of the self-image of the early modern era could not be overlooked. There was a choice of two ways of answering it.

The first was taken by the proponents of subjective or individualistic natural rights. They attempted to reach a new social consensus by making the autonomous individual and his rational powers of judgment the central point of the new meaning to be given life. By way of a mutually agreed-upon contract amongst the rationally endowed members in a pre-governmental natural state, political rule and a social system was to be justified solely on the secular plane. The demand of inviolable human rights, which even take precedence over the institutions and the process of forming political objectives in democracy, is the historically powerful consequence of this approach. Friedrich Schiller erected a literary monument to it in "Wilhelm Tell." "No, there is a limit to tyrannical power," we read in the famous Rütti scene, "if the oppressed finds no rights anywhere, if the burden becomes unbearable — he reaches beyond with calm spirit to heaven and takes down his eternal rights hanging there, inalienable and inviolable like the stars themselves." Indeed, what Schiller has Stauffacher say is an idealistic characterization of subjective natural rights: the moment a government violates pre-governmental fundamental and human rights, the individuals revert to the "old pristine natural state." In it, "man faces man" — as originally equal and free men. Thanks to his subjective natural rights, "if nothing else will do," he can resort to his "ultimate

means," the sword, as Schiller puts it, to defend "the highest of boons," his human dignity, against the exactions of the tyrant.

There can be no doubt that not only human rights as justified by subjective natural rights are individualistic in character. Even reason, which they are based on, is pluralized in itself, because it follows from the individual powers of judgment of the originally equal and free individual. This premise becomes very apparent in the controversy over religious tolerance during the English civil-war period of 1642 to 1649. The quest for religious truth, in the opinion of Milton and many other pamphletists of the parliamentary camp, as we must interpret them, is a process broken by errors. It indeed depends on the reasonable capacity for judgment of the individuals to survive. But it remains aware of its limitations and thus must always rely on the confrontation with other opinions. A debate of this kind, which upgrades error to a necessary element of the quest for truth, requires an institution which is beyond ecclesiastical and governmental monopolies on interpretation: a critical public where only one authority prevails, that of the better argument.

The other way was taken, since the publication of Thomas More's "Utopia" in 1516, by the utopians. In the tradition of radical anti-individualism inspired by Plato's "Republic," they wanted to join together constructively what was becoming increasingly divergent. All the same, they had one thing in common with the proponents of subjective natural rights: reverting back to the cosmically hierarchical thinking of scholasticism was out of the question for them. Instead of referring back to the worn-out traditional structures of the Middle Ages, they relied on

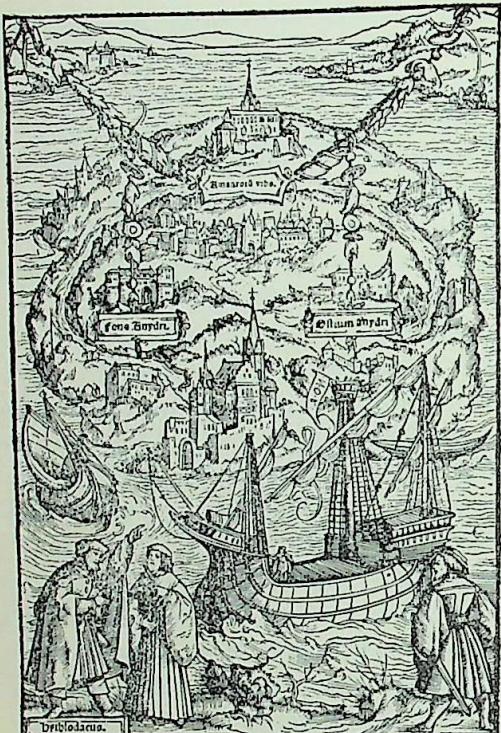
the constructivity of secularized reason and on the universalism of its claim to validity, as well. But in contrast to the contractualists, they rigorously rejected the process of individualization of the modern era. Instead, their models had only one goal: to end the individualization and fragmentation of the spiritual and material foundations of society by utopia of an intrasecular whole.² This goal presupposed from the beginning the premise that not the reason of the individual, but the collective reason of the body politic to be established, in the concrete way it would evolve in its institutions and the solidary forms of living together, must be the lever with which the crisis of the modern era is to be ended.

The Great Utopians' Attitude towards Human Rights

But now, what does the utopian theoretical approach have to say regarding human rights? Andreas Voigt correctly distinguished in 1906 between anarchistic and archistic utopias. In the first category he included those models which are based on the "social ideal of absolute personal freedom": they reject all restriction and any kind of rule and thus its authorities such as government or police, as well. In contrast to this, the ideal of the archistic utopia is "that of a state with strong, comprehensive central authority." The relations amongst the state's subjects are very strictly regulated: "freedom is only for the rulers; the masses must simply submit to the laws of the state and the decrees of the authorities."³ Regarding the anarchistic type of utopia, the question of its attitude towards human rights is quickly answered: in it, subjective rights which can also be defended

against others by corresponding authorities, if need be by force, are irrelevant. In Rabelais' ideal community, Thelema Abbey, described in his satirical novel "Gargantua and Pantagruel," published in 1532, there is but one single rule of conduct: "Do what you like!" There is no code of conduct resembling laws. The people living in Thelema were "not required to live in a definite way (...) by laws, statutes, or rules; they arranged their lives completely in accordance with their wishes and preferences: they got up when they wanted and ate and drank when they felt the need and worked and slept when they felt like it."⁴ In Gabriel de Foigny's Australia utopia, written in the latter half of the 17th century, all the members of the ideal body politic follow the imperatives of reason and the law of nature.⁵ Therefore there is no need for institutionalized human rights, positive laws, or lawyers. Courts of law are unknown, as are legally regulated modalities in the execution of a trial. This pattern was followed by Diderot in his Tahiti utopia in the tradition of the "noble savage" 100 years later. There is at most a certain sanctioning authority exerted by the dominant mores and customs of the natives.⁶ And William Morris's utopia of a perfect communist society, published in the latter half of the 19th century, provides neither for human rights nor for a codified legal system. A few general rules accepted by all are sufficient to correct possible deviations from peaceable conduct.⁷

It is characteristic that in archistic utopias, as well, which go back to Plato and More, institutionalized human rights play no part. They have no place there because the state of the utopian body politic is a priori in agreement with the objectives of the individual: it allegedly embodies natural rights in such an ideal way that their



Woodcut illustration in Sir Thomas More's "Utopia."
(Photo: Archiv für Kunst und Geschichte)

codified "declaration" would in itself be a contradiction; there is no point in anybody suing for something that he has long since been provided with by claiming it to be his natural right. What is more, the entire context of the sphere of subjective privacy, in which individual human rights take on meaning, is lacking, because there is no longer any difference or tension between the requirements of the individuals and those of the body politic. Even the family's house in More's "Utopia" is public: the doors are easy to open, we read, they "let anyone in: so there is no private sphere at all. For even the houses change every ten years by drawing lots."⁸ In his "Sun State," Campanella went even one step further: every six months the authorities write on the doorpost which dormitory individuals are to sleep in.⁹ Not only meals are taken in

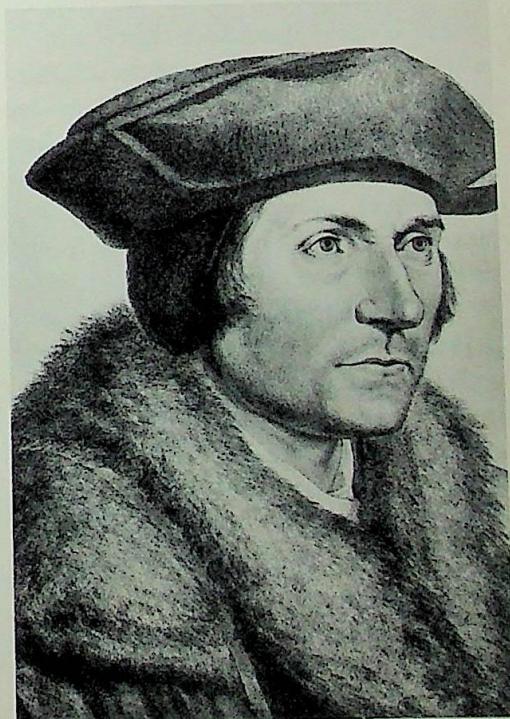
public. The costume, head covering, and hairdress are also uniform.¹⁰ Even sexuality is under the strict control of the authorities.¹¹ With the individual aspect thus eradicated, human rights lack all relevance: indeed, in More and Campanella one looks in vain for a sphere of privacy which can be protected from state intervention by codified individual rights. In More's "Utopia" there are consequently only a few laws; they are clearly worded and understandable to everyone. The individual must plead his own case before the judge. Lawyers are prohibited on principle. In this way there would be "fewer digressions, and the truth would be easier to arrive at."¹² In Campanella's "Sun State" one also looks in vain for any judicial authority in the sense of the separation of powers. The leading members of the various professions exercise jurisdiction. In keeping with More's ideas, the citizens of the "Sun State" have no idea of a written indictment or lawyers. Accusations are brought forward publicly before judges and authorities.¹³

In the early Enlightenment, however, utopian thinking seems to break with this overriding of human rights by the "powerful" state. In any case, in Denis de Vairasse's "History of the Sevarambs," frequent mention is made of the "natural" rights of individuals in a way that is not found in the Renaissance utopias: they even move up to the rank of "fundamental laws" of the state. De Vairasse cites three pre-governmental rights which follow from reason itself and which are intended to secure equality of birth and freedom of conscience and opinion: The right of self-preservation for every individual: it can only be redeemed if the preconditions of individual material production such as eating, drinking, sleeping, etc. have been met. 2. The right

happiness. Its realization amounts to abandonment of the "madness and disorder of the emotions." 3. The right to reproduction based on love guided by reason.¹⁴ Raised to the rank of fundamental law, the government may not decree anything which violates these "natural rights." But this possibility is just as hypothetical as the right to resistance it is based upon, because in the utopian state the Sevarambs there is complete identity between the king and his people. No one has reason to complain about him, because one knows that everything he does is done for the common weal."¹⁵ He would be surprised if the state has no opposition or popular uprising to fear. Nobody questions his authority. Everyone submits to it. 150 years later, with the Industrial Revolution of the 19th century in full view, Cabet took up this identity thesis once again. His ideas, the utopian state is relieved of all police functions because all citizens view themselves as called upon to see to it that the laws they have themselves decreed are obeyed and to report any infraction they have witnessed to the proper authorities.¹⁶ Cabet's thinking on the unity of the rulers and the ruled in his Icarian utopia is so seamless and without fissures that no room is left for a sphere assigned exclusively to individuals: freedom of opinion, which is not a staple component of classic human rights, is as irrelevant as codifications of fundamental laws, notaries, lawyers, policemen, prison guards, hangmen, and judges. The only crimes which are punishable are tardiness, exactness in distributing or demanding, and calumny.¹⁷ These misdemeanors are taken care of as "near the base" as possible, i.e., without an aloof judicial bureaucracy with a hierarchistic order of authority: besides the popular assembly, every school and factory has its own court of justice.¹⁸

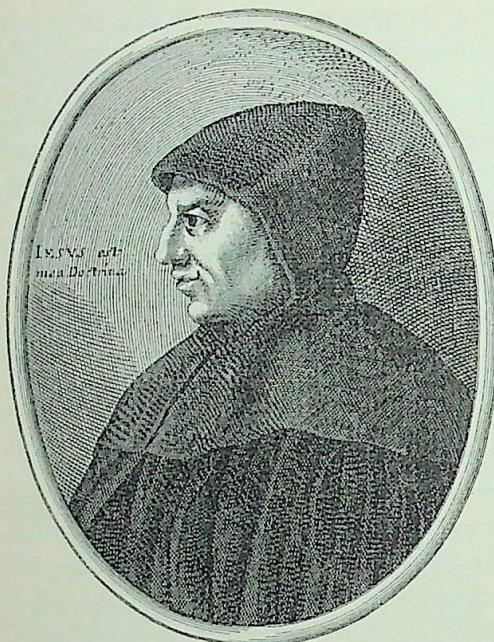
The Repressive Aspects of the Classical Utopian Project

If the proponents of modern human rights took up stance against the repressive power of the state in order to secure an inviolable sphere of individual privacy, in the classical utopian debate of modern times the fronts were turned exactly the other way round. According to the central premise, all "natural rights" are realized on principle in the ideal body politic. But those who do not share in this insight, for whatever reasons, are deprived of all "natural rights": they must expect either severe punishment or, in the best case, commitment to a mental institution. It is no accident that in Campanella's "Sun State" mention is never made of crimes the state commits on its citizens;



Sir Thomas More (1478 to 1535).

(Photo: Archiv für Kunst und Geschichte)



Tommaso Campanella (1568 to 1639)
(Photo: Archiv für Kunst und Geschichte)

but misdemeanors towards the state do indeed result in immediate capital punishment. An intelligence system of conscience surveillance is spread over the citizens of the "Sun State" like a tightly woven network. The "purification of the conscience" takes place by means of confessional which all are obliged to undergo; it in turn instructs the authorities on the citizens' attitude towards the body politic, so that it has time to take steps to maintain peace and order.¹⁹ A similar argumentative pattern may be found in Morelly's "Book of Natural Law." Whoever tries to introduce private property to the utopian state described in it is declared an enemy of humanity for this subversion and incarcerated in a cavity which, as it has bars and is sealed off from the outside by thick walls, also serves as his grave.²⁰ From fear of rebellions, the citizens of Fontenelle's Philosophers' Republic do not flinch even from geno-

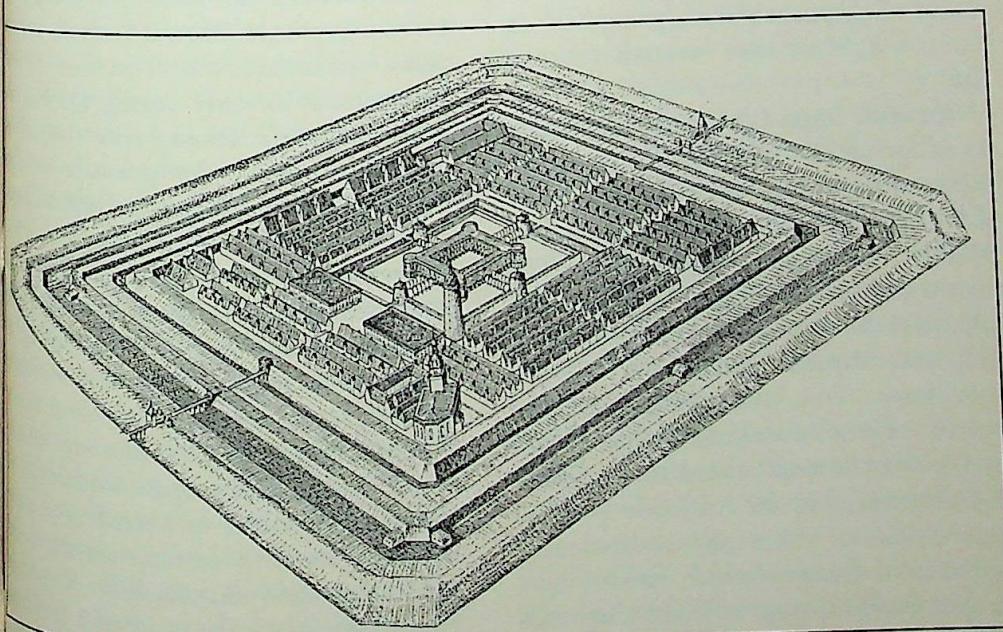
cide on their slaves in the interest of the stability of their body politic.²¹ In Mercier's "The Year 2040," censorship is as much taken for granted as it is in Cabet's Republic of Icaria. Mercier calls the undesirable literature, which is publicly burned, an "expiatory sacrifice which we bring to truth, good taste, and common sense."²² At the same time, authors who disseminate "dangerous principles" must expect to be visited every day by two virtuous citizens who will exert their powers of persuasion until they repent.²³ In Cabet's Republic of Icaria, apart from national poetry and national prose the only writings which may be printed are those which promote progress. As to literature which does not meet this standard, it is time "consigned to the flames as useless or, which harmful rubbish, so Icaria knows how to make a clean slate so as not to encumber the younger generation's efforts at progress. Fire is not a bad means in such cases,"²⁴ Cabet writes. Even many anarchistic utopias couldn't escape the constraints of eliminating whatever resisted subsumption under collective reason. When it turns out that the narrator in De Foigny's Australia utopia does not meet the requirements of absolute reason, he sees himself faced by a death penalty, which he can only escape by fleeing.²⁵

The repressive aspects of the classical utopian project only reveal what was at its core from the beginning: the collective reason it had adopted had a monistic tendency.²⁶ Indeed, the utopians assumed that their ideal body politic is the emanation of an "absolute" knowledge which is to them universal, true, and without alternative. As it comprises the past and the future, this knowledge can only be attributed to a supraindividual entity, i. e., the existing institutions of the ideal body politic itself. On the other hand, the absence

conflicts and transparency are signals for the elimination of all "alienations," beginning with the abolition of pluralistic spheres of activity, then leading to the demise of the state as an organization of society, down to the lack of institutional guarantees for reaching individual consensus or settling conflicts in the form of fundamental and human rights. The freedom and independence of individuals has a priori no ground to stand on under these circumstances because the individual only counts inasmuch as he participates in the collective vision. Modernization is thus taken by utopians to mean a harmonic and conflict-prone state of society. At the same time, they expect from this "identity," which is in agreement with itself in all its parts, a maximum development of man capabilities which has been reflected since Plato in the vision of the new man."

The "Positivization" of the Utopian Debate and Its Consequences

No one will be able to claim that the utopian project, particularly in its archistic version, has been without historical consequences. It is no accident that the most ardent apologists of capitalist industrial society, the proponents of what is called "technocratic conservatism," openly or tacitly take up the premises of 19th-century utopian thinking. To the extent that they became part of the social structure of the "technical states" which were emerging, they were ideally suited to be used for conservative interests.²⁷ In the "hard" structures of the hierarchical world of labour, which is characteristic of not a few 19th-century utopian plans, they saw a "life order" with a more stable governing structure than those of the pre-industrial society based on the estates. The termination of the class struggle by placing absolute priority on increased production,



Albrecht Dürer's ideal city in drawings and sketches in his work, "A plan to group the estates' society spatially," published in 1527.

a classic postulate of 19th-century utopian thinking, they found corroborated in the social partnership of the highly industrialized western countries after World War II. The utopians' realization that due to the ever more complex division of labour everyone is increasingly dependent on everyone else on an ever-expanding scale, they felt had become reality in the development of "material constraints" and socio-technical "superstructures" confronting the individual as an unavoidable fate. By encompassing the entire system, this utopian pattern of the establishment of the technocratic unity of social processes also placed its stamp on the social order of the Soviet type, which was likewise under the spell of the expectation of limitless quantitative economic growth and an unbroken trust in the universal potential of technology — a potential from which the 19th-century utopians expected the solution to all emancipatory problems. But in one crucial aspect they came closer to the classical positions of the tradition of utopian thinking going back to Plato and More than western societies did.

Friedrich Engels did indeed demand a renunciation of "recipes of the eating-house of the future," as it is stated in the afterword to the second edition of volume 1 of Marx' "Das Kapital." But within the Marxist tradition, the Bolsheviks were the most blatant in disregarding this anti-utopian "iconoclasm." To be sure, Lenin, Trotsky, Buchananin, and others did so in characteristic fashion.²⁸ But first it must be emphasized that it wasn't their utopias, but the consistent political exploitation of a complex revolutionary situation of upheaval which enabled them to gain political power. When they then exercised it, their actions were guided without a doubt by a utopian level of ex-

pectations. During and shortly before the outbreak of the October Revolution, they were guided by a utopian plan whose archaic and anti-institutional elements cannot be overlooked. This plan was based on the thesis of the "demise of the state" and a simultaneous simplification of economic functions — a thesis which amounted to democratic as well as economic primitivism. As on the one hand the spontaneity of the masses was expected to organize democratic processes, perform the ordering functions of the state without problems, and prevent the formation of bureaucratic apparatuses, it was expected on the other hand that the only qualification for operating an efficient economic system was the ability to read and write and perform the four basic operations of arithmetic. The technicians and bookkeepers of the old system who could as yet not be dispensed with were to be placed under the control of the armed proletariat.

But this utopian plan of a creative activity of people liberated from institutional constraints was soon to turn into its opposite. Already during the Revolution, Lenin and Trotsky saw themselves compelled, under the pressure of economic collapse in Russia, to replace mass spontaneity with the dictatorship of the works managers. Rigid compulsory labour maintained by instruments of governmental force has been a topos of authoritarian social utopia since More. At the same time, it was already clear in the Soviet Union by the late twenties that not unlike classical utopian tradition — an all-inclusive system of bureaucratic regulation permanently administers the entire production and distribution of goods. Similar things can be said of a political constitution in the narrower sense. The social orders of the Soviet type are char-

criticized by the claim that the Communist Party has a monopoly on truth as well as a political one. This self-proclaimed "avantgarde of the working class" used its historic model in the philosophers Plato's "Republic" and the elites of the utopias of the early modern era modelled on them. It justifies its claim to power not democratically, but — like the utopians from the latter half of the 18th to the beginning of the 20th centuries — by referring to the philosophy of history. "Only the Party organization can impart theory and practice, can have insight into and form the totality of history, only it can lead humanity to the realm of freedom."²⁹ At the same time, universal consent to this goal is presupposed a priori, as shown by the self-imposed constraint to suggest a nearly 100 % vote in favour of the policies of the Communist Party. But there is another important analogy in addition. In the social utopias of etatist or anarchistic origin, individual human rights play no part, as has already been shown: it seems pointless to guarantee something institutionally which has allegedly already been realized. Since furthermore the reason of the "whole" in the form of the perfect institutions of the "best" body politic is of a higher quality than that of the individuals, individual human rights have already by argument no ground to stand on. From this premise the Bolsheviks derived far-reaching consequences right after coming to power. § 23 of the first Soviet constitution deprived all opposition groups and individuals of the active and passive right to vote. And the prohibition of forming political groups at the 10th Party Congress in March, 1921 was the beginning of a chain of events which ended in the scrupulous liquidation of socialist pluralism. What took its place was emphatically

extolled by György Lukács in 1923: "The discipline of the Communist Party, the unconditional absorption of the entire personality in the practice of the movement." This was the "only possible way of attaining genuine freedom."³⁰

Traces of this thinking can even be found in the Soviet constitution of 1977. Here the old structural characteristic of utopian thinking can once again be found: the rights of individuals can never be pre-governmental — like classical human rights — but can always be granted only within the scope of the given order, which in turn purports to embody a priori the interests of all workers. Thus, the citizens' freedom of speech, press, assembly, demonstration may only be exercised "in agreement with the interests of the people and to bolster and develop the socialist order."³¹ The freedom to form associations is subject to the restriction that it be in agreement with the goals of communist development," as is the freedom of scientific, technical, and artistic activity.³² The most important political fundamental rights and the basic right to freedom of activity and development are thus committed to conformity to the system. Article 59 accordingly establishes an inseparable correlation between the realization of rights and fulfillment of duty. It commits the citizens not only to obeying the laws and regulations of life in the socialist body politic. Beyond that, the citizen pledges "to prove himself worthy of the lofty designation 'Citizen of the USSR'."³³ This is in keeping with Article 62, which demands the active obligation to be loyal to the Constitution not only from functionaries of the state, but from all citizens.³⁴ There can be no doubt: what is true for the constitution of the Soviet Union was more or less true of all countries with a social order of the Soviet

type: "fundamental rights (...) are only valid for the absolutely conformist citizen. The political dissident or a citizen who takes up a position outside this order for other reasons cannot invoke it, because he doesn't fulfill the preconditions they demand, the absolute identification with the order as it exists and the total submission to it."³⁵ The legacy of classical utopian thinking could hardly have been given "positive" form more trenchantly.

Was the Classical Utopian Project an Historic Error?

The great utopians of modern times operated on the assumption that with the removal of capitalistically utilized private property, social antagonisms would also become a thing of the past: the disappearance of class conflicts would also result in the demise of a state which is set apart from society. Where neither state repression seems structurally necessary nor a private sphere in need of protection exists, individual human rights have no ground to stand on. As the decline of the Soviet-type social orders shows, this premise was unable to stand up to the real needs of the citizens of the Eastern European countries in the long run: the victory was won by those small minorities who sued for human rights under unspeakable dangers. The competition between them and their Marxist-Leninist version seems, after the upheaval of 1989 in the countries of Eastern Europe, to have been decided in favour of the normative postulates of the early-bourgeois libertarian movement, because a system which assigns a monopoly on truth and politics to a small elite is incapable of reacting innovatively to new challenges. This fact was already repeatedly empha-

sized by the Marxist Social Democratic Karl Kautsky in his critique of the Bolshevik October Revolution. New doctrines and insights are always first put forward by minorities. Suppressing them amounts to preventing further progress. It is much the same when individual human rights are prohibited.³⁶ If civil liberties cannot be exercised, the talents of millions must be wasted.³⁷ The result is a paralyzing stagnation in all areas of society. And finally, a system based on the tutelage of the great mass of the population loses its legitimacy. Incapable of developing true loyalty between the citizenry and the body politic, it must collapse like a house of cards the moment the centralized surveillance apparatus ceases to function, because it will be subverted by mass actions. If I am not mistaken, this realization is one of the main lessons of the upheavals of 1989 and 1991.

Was thus classical utopian thinking, attempt to anticipate a condition in which individualistic human rights are superfluous, historically speaking the wrong road to take? This question cannot be answered with a simple "yes" or "no." On the one hand we know that the utopian approach to attaining collective emancipation without a true reconciliation with individual needs was a failure historically. It demands a price that hardly anyone is willing to pay: the loss of subjective autonomy, with corresponding tutelage of each individual by a bureaucratic apparatus. On the other hand, everyone must know what he is about when he abandons the unfulfilled demand of utopian thinking, the goal of pansocial solidarity based on a reasonable consensus. When this premise of classical utopian tradition is dropped, there are basically only two alternatives left. Either we beat a fundamentalistic retreat to some traditional

Democracy formation or other in which the historical attainment level of human emancipation is rescinded. Or we opt, in good "postmodernist" fashion, for a version of the individualistic competitive society whose midpoint is the unrestricted right of the individual to protect his interests. But as long as social and ecological conditions predominate in large parts of our planet which structurally preclude the establishment of human rights because they are independent of the objectives of individuals and their governments, it is difficult to dispute that their universal fulfillment cannot be expected from traditional utopian scenarios nor from those based on individualistic private property. Rather this presupposes material conditions of a collective nature which make not only the protection of the natural environment and fundamental social reforms imperative, but also the solidary support of Third and Fourth World countries. It is the lasting achievement of classical utopian thinking to have pointed to this born in the flesh of the industrial countries. In my opinion, it is no small achievement.

English translation by Philip Mattson

munistischen Gesellschaft. Ed. Gert Selle. Reutlingen 1981. p. 91, 111 f., 114. — ⁸ More, T.: Utopia. In: Der utopische Staat. Ed. K. J. Heinisch. Reinbek 1970, p. 52. — ⁹ Campanella, T.: Sonnenstaat. In: Der utopische Staat (cf. note 8), p. 128. — ¹⁰ Op. cit., p. 125. — ¹¹ Op. cit., p. 131. — ¹² More, T. (cf. note 8), p. 85. — ¹³ Campanella, T. (cf. note 9), p. 151. — ¹⁴ Vairasse, D. de: Historie der neugefundenen Völker Sevarambes. Nürnberg 1717. p. 54. — ¹⁵ Op. cit., p. 230. — ¹⁶ Cabet, E.: Reise nach Ikarien. Berlin 1979. p. 117. — ¹⁷ Op. cit., p. 115 f. — ¹⁸ Op. cit., p. 119. — ¹⁹ Campanella, T. (cf. note 9), p. 153. — ²⁰ Morelly: Gesetzbuch der natürlichen Gesellschaft etc. Ed. W. Krauss. Berlin 1964. p. 186. — ²¹ Fontenelle, B. Le Bovier de: Historie des Ajaoiens. Kritische Textedition v. H.-G. Funke. Heidelberg 1982. p. 78. — ²² Mercier, L.-S.: Das Jahr 2440. Ein Traum aller Träume. Ed. H. Jaumann. Frankfurt a. M. 1982. p. 114. — ²³ Op. cit., p. 39. — ²⁴ Cabet, E. (cf. note 16), p. 112. — ²⁵ Foigny, G. de: Nouveau Voyage de la Terre Australie etc. Paris 1693. p. 157 ff. — ²⁶ On the differentiation between the monistic and pluralistic concepts of reason cf. Križan, M.: Vernunft, Modernisierung und die Gesellschaften des sowjetischen Typs. Eine kritische Interpretation der bolschewistischen Ideologie. Frankfurt a. M. 1991. p. 41 f. — ²⁷ Cf. Saage, R.: Historische Dimension und aktuelle Bedeutung des Topos „Technischer Staat“, in: Politik und die Macht der Technik. Ed. H.-H. Hartwich. Opladen 1986. p. 52–68. — ²⁸ Cf. on the following the exhaustive study by Euchner, W.: Die Degradierung der politischen Institutionen im Marxismus, in: Leviathan, vol. 18. (1990), p. 487–505. — ²⁹ Flechtheim, O. K.: Rosa Luxemburg zur Einführung. Hamburg 1985. p. 62. — ³⁰ Lukács, G.: Geschichte und Klassenbewußtsein. Berlin 1923. p. 322. — ³¹ Verfassung (Grundgesetz) der Union der Sozialistischen Sowjetrepubliken. Angenommen auf der siebenten Außerordentlichen Tagung des Obersten Sowjets der UdSSR der neunten Legislaturperiode am 7. Oktober 1977, Berlin 1978, p. 28. — ³² Op. cit., p. 27 f. — ³³ Op. cot., p. 30 f. — ³⁴ Op. cit., p. 31. — ³⁵ Westen, K.: Über das Menschenrechtsverständnis der sozialistischen Staaten. Die neue sowjetische Verfassung. In: Menschenrechte. 2. Ihre Geltung heute. Ed. R. Kurzrock. Berlin 1981. p. 70. — ³⁶ Cf. Lübbe, P. (ed.): Kautsky gegen Lenin. Berlin – Bonn 1981. p. 44 f. — ³⁷ Cf. Euchner, W.: Vom Nutzen der Natur- und Menschenrechtsidee für die Linke. In: Komitee für Grundrechte und Demokratie (ed.): Jahrbuch 1986. Einhausen 1987. p. 109 ff.

Order into Chaos?

How Scientific Knowledge Shapes our World View

Gerhard Vollmer, Braunschweig

Science is a search for order. This goal is not new; it is inherent to all levels of world views. As a result, mythic and scientific world views show, for all their differences, striking similarities: They both regard the world as beginning from chaos, from a primeval state both rich enough to produce order and structure and poor enough to make further explanation dispensable.

In its quest for order, even science runs into definite limits. These limits are, first of all, set by quantum theory, metamathematics and chaos theory.

Chaos as Mythic Primeval Substance

In recent years, chaos has been the subject of an astonishing number of scientific publications. Is it possible to say anything at all about chaos? Is it not by itself (or at least by definition) just an absolute mess, without any regularity, pattern or structure? Is it not characterized by complete lack of order? Beyond this negative characterization, is it possible to say anything meaningful about chaos? What does the term "chaos" actually mean?

We will not make the mistake of asking for the "true" or "real" meaning of a word. Such "true" meanings do not exist. Neither the most complete etymology, extending far into the past, nor the most comprehensive cultural history, nor the most careful hermeneutics can unearth

such a primeval meaning. They can only give heuristic (and perhaps plausible) hints, which of course we can make use of here, too.

The word "chaos" is of Greek origin and is related to $\chi\alpha\iota\omega$ (chaino, to gape,

Professor Gerhard Vollmer, born in 1943 in Speyer on Rhine. Studied mathematics, physics and chemistry in Munich, Berlin and Freiburg/Breisgau. Doctorate in Freiburg in 1971. Till 1975 ass. prof. of theoretical physics in Freiburg,



while at the same time continuing studies in philosophy and linguistics. Ph. D. in philosophy in Freiburg in 1974. From 1975 to 1981 at the Department of Philosophy, University of Hannover. From 1981 to 1991 professor at the Centre for Philosophy and Foundations of Science, University of Giessen. Since 1991 professor of philosophy, Technical University of Braunschweig. Fields of research: logic, epistemology, philosophy of science, foundations of physics and biology, natural philosophy, artificial intelligence. Numerous publications, among others: Evolutionäre Erkenntnistheorie (1990); Was können wir wissen? (1985/6); Wissenschaftstheorie im Einsatz (1993).

Prof. Dr. Dr. Gerhard Vollmer, Seminar für Philosophie, TU Braunschweig, Geysstrasse 7, D-3300 Braunschweig

open up, yawn). There is thus no mention at all of a lack of order, and order and chaos are thus not opposing concepts in every respect. It is particularly indicative that chaos is also the initial and primeval state of the world in Hesiod's cosmogony:

First arose the Chaos. And later the Earth... from Chaos arose Night and the darkness of Erebus.

Carl Friedrich von Weizsäcker rightly points out that both the Babylonian hymn "Enuma elish" and the Nordic creation myth also start with such a structureless state.¹ Thus, the Elder Edda reports:

It was the primeval time when Ymir lived:
Neither sand nor sea nor billows of salt,
Neither earth below nor heaven above,
Bottomless chasm and grass nowhere.

The Germanic word for this initial state is "ginnungagap" or "yawning chasm" ("gap", originally a cognate to "chaos", still means opening, chasm, or cleft). So at the start of the world, there was not an unholy mess, but a *structureless* primeval substance.

Hesiod pictures chaos as being dark and windy. Aristotle sees chaos as empty space without any properties. However, the Stoic doctrine regards chaos as being characterized by lack of determinacy, form or *order*, and this view is continued in Ovid's Metamorphoses. Christian thinkers, too, see the main characteristic of chaos in the lack of order and connect this with the biblical Tohuwabohu.² On the other hand, Ramon Lull (c. 1232 to 1316), for example, regards chaos as nothing but the *primeval matter* made by God, containing all principles of creation.³ A similar characterization applies to Paracelsus. As we might have expected, etymology and the history of concepts do not enable

us to fix the concept of chaos unambiguously. They do, however, make it clear that originally the lack of structure and not the idea of a complete mix-up was connected with the concept of chaos. This kind of chaos plays an important role in many cosmogenic myths.

The Explanatory Function of Cosmogenic Myths

Myths are fascinating. They exist in all cultures and they serve numerous functions. They present facts, offer explanations, justify the social and political order, mirror psychological relationships and developments, and account for customs and rites.

One of the functions of myths is to answer the natural question as to how everything began: my tribe, mankind, the gods, time, the world. All such explanatory attempts are confronted with a particular problem: They lead to an infinite regress. Once the chain of questions has been started, it is not so easy to end it. Worlds, gods and men arise or are created. But nothing can come of nothing. And if there is a creator, a demigod, an architect, where does he come from? In Babylonian, Greek and Germanic myths, the world as we know it is made from the corpses of conquered predecessors, slain gods and giants (Tiāmat, Uranos, Ymir). But just where do the latter come from? Generations of gods replace others as rulers of the world. But where does the first and oldest generation stem from?

In order to avoid the infinite regress threatening here, we must start (or end) with a state that is so poor in structure that the question of its origin does not seriously arise. For this purpose our *chaos* is quite suitable. More exactly: Chaos as an initial state must be so constituted that

it is both rich enough to produce structures, but also poor enough to make further questions pointless.

Strictly speaking these two demands are not totally compatible. For, either chaos comes without any structure, then it cannot produce structure; or it already has a minimal structure, which then should be explained. But even a myth with a multitude of levels must stop somewhere.

Chaos and the Quantum Vacuum

There is an illuminating analogy in modern physics to this concept of chaos: the concept of the *vacuum*. Originally, as in Democritus and later Atomism, the vacuum was conceived of as *absolute emptiness*, as a space totally void of matter. It was debatable whether nature actually permitted such absolute emptiness, and whether it could be produced in some way. Conceptually, however, it seemed to pose no particular problem.

The concept of the vacuum became more complex with the introduction of fields through electrodynamics and with the dynamic view of space in the General Theory of Relativity. Absolute emptiness has no physical existence. Even sections of space without matter or thermal radiation are filled with fluctuating electromagnetic fields. This can in fact be demonstrated by means of subtle effects. Therefore, today vacuum is defined as the energetically lowest stable state a section of space permeated with fields can be in. Such a vacuum still corresponds to the *simplest state* which can be found in nature. However, it is not structureless at all: it can decompose, degenerate, be charged, be polarized, exert forces and do even more.⁵ These statements inevitably provoke the paradoxical question: Is the

vacuum really empty?⁶ In fact, the vacuum as understood in modern physics is not empty; nevertheless, it cannot be "emptied" further.

If we ask the physicist about the primeval state of the world and thus ask for a physical cosmogony, the best answer we can receive today from cosmologists and elementary particle physicists is the *quantum vacuum*. This quantum vacuum corresponds closely to the chaos of cosmogenic myths not only in its function (as primeval state), but also in its structure (as the simplest system which can be physically realized). Again, in spite of all fluctuations, what is essential is not its *messiness*, but its *poverty of structure*, which makes further questions about a preceding state or cause meaningless.

Order and Orientation:

More Functions of Cosmogenic Myths

In view of the fact that both chaos and the quantum vacuum are able to break off the chain of questions, it is perhaps tempting to regard Greek cosmogony as being quite up to date. It lies however in the nature of the problem (or better in the nature of *man* and his questioning) that creation myths always lead from chaos to cosmos. The mythologist Mircea Eliade has shown this with many examples.⁷ The cosmogenic (hence explanatory) myths have, at the same time, an indispensable orientating function.

Orientation in space, in unknown territory or on the unmarked surface of the sea, was vitally essential for the life of "primitive" man. Therefore the determination of a fixed central point and of the four directions of the compass were equivalent to ordering or even to creating the world. This orienting achievement amounts to a transition from the (struc-

the vacuous) chaos of homogeneous space to an (organized) cosmos with a fixed central point and definite directions; at least it is seen in this way.

A convincing illustration of this conception is provided by a ritual of a tribe of Australian aborigines, the Achilpa, a ritual which itself originates from a creation myth. According to this myth Numunakula, a divine being, first „cosmisized“ the territory of the Achilpa: he created the progenitor of the tribe and its institutions. He then formed a stake from the trunk of a rubber tree, climbed up it and vanished into heaven. The Achilpa take this stake with them on their continuous wanderings. Its inclination indicates the direction they must take. This holy stake represents the cosmic axis. It offers both orientation and the connection to heaven. If it were broken up or lost, that would be a catastrophe, almost literally the "end of the world". Thus the stake plays both a cosmogenic and an orientating role. More exactly: orientation, classification and order are equivalent to the creation of a world.

This Australian rite is but one example out of many. Its cosmogenic interpretation is confirmed by similar myths, rites and legends of primitive peoples in all parts of the world, by tales about climbings into trees, on lianas, on spiral-shaped mountain paths, on rainbows, etc. These myths demonstrate the ubiquitous human need to live in a *cosmos*, in an organized space which has a central point and, precisely at that point, an opening to heaven. Thus Eliade submits:

We find the same ritual motif again and again, in the most disparate cultural contexts. To settle in a country means something like founding a world. In other words, man gradually occupies more and more zones of the planet and "cosmisizes" them in accordance with

the precepts revealed by cosmogenic myth. Thanks to this myth, man, too, becomes a creator. At first sight he just repeats the same archetypal gesture again and again. In reality, however, he tirelessly conquers the world, organizes it and converts its natural landscape into a cultural setting. This is the great secret of the cosmogenic myth: it drives man to create; it opens ever new vistas for his creative spirit.⁸

Levels of World Views

Myths fulfill many functions. One of them is the world view function, in which they offer descriptions, explanations and orientations for the world as we know it. World views are mental patterns in which the knowledge about the world, about man, and about his place in this world, are combined to a whole. There are myths in all cultures. Not all cultures, however, have been satisfied for long with myths in their attempt to interpret and master the environment, not even with respect to their world view function.

Various levels of world views can be distinguished. A possible classification is given in Table 1.

World views can replace each other. Initially, magical and animistic notions hold sway. They play an important role in the development of mankind and are still dominant in primitive tribes. The world views contained in myths, are already on a later level and on a "higher" one in so far as they serve to *explain* what is found — as demonstrated by the cosmogenic myths discussed above.

The next step brings us to philosophical and rational world views, as developed in the Mediterranean area, particularly by the Greeks. Their rational character is mainly due to their restriction to description and explanation, i. e. to the world view function without aiming at

Levels of World Views	Example: Origin of the World	Descriptive Value	Explanatory Value	Internal Consistency	External Consistency	Testability
1. Magic-Animistic	Shamanism	+	?	-	-	-
2. Mythic-Theological	Babylonians, Genesis, Greeks, Teutons	+	+	?	-	-
3. Rational-Philosophical	Pythagoras, Democritus, Plato	+	+	+	?	-
4. Rational-Scientific	Physical Cosmology	+	+	+	+	?

Table 1: Levels of world views. Further columns exhibit examples from cosmogony and some (simplified) criteria for the assessment of such world views.

normative justifications; it is based also on the fact that they presuppose only a single primeval substance or as few as possible; that they can be questioned argumentatively; and that they avoid at least *internal* inconsistencies: *logic* here becomes an instrument of criticism. On the other hand, these world views are generally not empirically testable and very often are incompatible with all background knowledge. External consistency and testability are demanded only at the next level, the scientific and rational, which is attained by means of modern science. Here then, *experimental experience* becomes the critical instrument enabling us to test and reject world views.

It would be tempting to give examples of these various levels of world views, as we have done with the mythic level. In principle, we could use the whole history of science for this purpose. Lack of space does not allow this. (Moreover, there is excellent literature on that.) Let us just emphasize three points.

First, these world views can only be passed through in the sequence given, without missing any step. (However,

knowledge can be forgotten, as we clearly see in the Dark Ages.)

Second, not every culture attains the rational or scientific level; there is no natural force or guarantee that a given level must be reached.

Third, *all* levels of world views can evidently be interpreted as a *search for order*. What we have emphasized for the mythic world views is also true for the other levels: they are attempts to structure and clearly represent the multifarious phenomena both within and around us. This is particularly true of science and of the world views offered by it.

The Aim of Science

If you ask scientists or philosophers of science to point out the aim of science, you will receive different answers. In particular, we must distinguish between theoretical (cognitive) and practical (application-oriented) aims. The following list names some theoretical goals of science: a complete description of the world, an economical condensation of all observations, the discovery of natural laws, com-

prehensive and deep explanations, prediction and understanding, knowledge of what keeps the world together at the most basic level, insight into the causal connections in nature, etc. Despite or perhaps just because of this diversity of aims one is tempted to order them into a science and perhaps even to look for a highest aim which would include all others and which could provide a certain unity of science.

Such an aim can in fact be named. It is the wish to exploit the redundancy of the world in order to describe it as *simply* as possible. To say it in the language of algorithmic information and complexity theory (a young mathematical discipline based on the work of Chaitin, Kolmogorov and Solomonoff), it is a question of finding a *minimal description of the world*, a description which cannot be further abbreviated without loss of content.

An Example

As an example let us assume that, in the past, we have observed a part of the world and have encoded our finite observation protocol in a binary sequence:

1101 0110 1011 0101 1010 1101 0110 1011
0101 1010.

Apparently, our description contains 40 bits. If we regard this as a *random sequence*, it can neither be shortened nor used to predict the next bit. If, however, you look more closely, you will (perhaps) discover, that the protocol contains the first 20-bit sequence exactly twice. The sequence is therefore redundant and can be abbreviated to "2 times 1101 0110 1011 0101 1010". If we imagine "times" being encoded by 2 bits, this then corresponds to $2 + 2 + 20 = 24$ bits. Moreover, the discovery of this regularity permits *predicting* the next step: another 1 can be pre-

dicted. Thus the discovery of regularities enables not only shorter descriptions to be made, but also predictions.

Looking even more closely you will discover a further regularity in our sequence. Each of the 20-bit sequences consists of four sequences of 11010 (which is somewhat disguised by the arbitrary spaces). The total sequence can thus be further abbreviated to "8 times 11010". As 8 is binarily encoded by 1000, i. e. by 4 bits, the total sequence contains $4 + 2 + 5 = 11$ bits. This formulation, however, does not allow for further abbreviations. Hardly any redundancy remains. In any case, we seem to be close to a minimal description. Nevertheless, as we have seen, regularities can fail to be recognized, and we can never be *certain* to have reached a minimal description.

What has been qualitatively depicted here can be made more precise with the help of concepts from algorithmic information theory such as Turing machine, minimal algorithm, complexity, and random sequence. We thus have a useful tool to analyze the aims and methods of the experimental sciences. Many scientific problems now appear in a new light. Here this can only be illustrated in the form of some theses.

Consequences for the Philosophy of Science

— Ockham's "razor", Mach's "economy of thought", Einstein's "simplicity" and other concepts such as the "elegance" of a theory are made more explicit and more precise by the concept of "minimal description". In contrast to positivism, phenomenism, or instrumentalism, the question here is not only one of condensing all *observations* made, of "saving the phenomena", but of giving a non-redund-

dant description of the *world*, however indirectly accessible the latter may be to us.

- To anticipate an obvious objection: Of course, every extremal principle, hence every principle of parsimony, as well, must presuppose some limiting conditions setting a lower limit to the alternative formulations. An *unlimited* economy of thought would mean to stop thinking altogether. Thus the intended minimal description must actually yield all available information about the world, and the permissible alternatives should contain no additional information, but only show redundancy.

- A better understanding of scientific procedures is now possible: the search for experimental data, for regularities, patterns and laws, for universal principles, for possibilities of reduction, and for unifying theories.

- Scientific *explanations*, too, are reductions of factual descriptions, laws and theories to less redundant ones. One can thus see in which sense explanations deepen our insight or our understanding.

- Thus it becomes clear that description and explanation are in no way mutually exclusive and that the inevitably descriptive character of the hypotheses of empirical science is no flaw.

- One understands why past experiences are transformed into expectations concerning the future. Only in this way do we obtain a minimal description of both past and future events (Solomonoff). This is an important aspect of the *problem of induction*.

- The postulate of objectivity (or the search for primary qualities) also fulfills the minimality postulate: Wherever it is possible to eliminate reference systems, subjects, observers, conventions, units of measurement, etc., by invariance conditions, redundancy will be reduced.

Classical Determinism

The classical ideal of a successful search for order is represented by Laplace's demon:

An intelligence knowing all the forces acting in nature at a given instant, as well as the momentary positions of all things in the universe, would be able to comprehend in one single formula the motions of the largest bodies as well as of the lightest atoms in the world, provided that its intellect were sufficiently powerful to subject all data to mathematical analysis; to it nothing would be uncertain, the future as well as the past would be present to its eyes.¹²

So Laplace maintains that under certain conditions the whole world would be calculable. It is instructive to make the pre-conditions and the consequences of this epistemological ideal clear. We try to do this in Table 2.

In this presentation use is made of the principle of "weak" causality: *equal causes have equal effects*. Classical physics has implicitly presupposed a much more powerful principle, the principle of "strong" causality: *similar causes have similar effects*. According to the latter, small deviations in the initial conditions would only have slight effects on the later states of the observed system; thus, small causes would not have arbitrarily unpredictable large effects. Laplace did not formulate this principle; we may however assume that he, like later physicists, would have unreservedly supported it. It is therefore not necessary to include the premise of absolute accuracy in Table 2, and the results of the calculations may then contain corresponding inaccuracies as well, i. e., inaccuracies comparable to the initial deviations.

Limits of the Search for Order

The history of science teaches us that the

search
aplace's
acting in
the mo-
universe,
the single
odies as
world, pro-
analysis;
future as
ts eyes.¹²
certain
be cal-
the pre-
of this
y to do
e of the
al causes
ics has
n more
iple of
ave sim-
er, small
s would
er states
, small
y or un-
did not
however
ysicists,
ed it. It
ude the
Table 2,
ns may
curacies
rable to
that the

research for order and structure, for regularities and natural laws, has been quite successful. There is, however, no guarantee that it always and everywhere will or must achieve its goal. In fact the limits to this approach have long been apparent. They lie firstly in the composition of the real world and secondly in the possibilities (or rather the limitations) of the cognizing subject. Thorough inspection shows all premises of Laplacian determinism to be false, in so far as they are not just epistemological idealizations of unlimited knowledge and ability to begin with. Here it is only possible to summarize some conclusions.

- The world is not deterministic. According to the usual interpretation of quantum physics absolute chance exists e.g. there is not only no cause for the spontaneous decay of a nucleus, but also (and even less an explanation).
- The world does not only consist of particles, but also contains fields. Classical determinism however can be extended to (classical) fields, so the discovery of fields in the 19th century did not yet seriously endanger determinism.
- Newton's equation of motion is not universally applicable, particularly not to particles without rest mass such as photons.
- (It can, however, remain open whether we know or can know all laws of force; even Laplace never claimed that.)
- Measurements may alter (disturb) the state of a system in a manner which can neither be predicted nor retrospectively be determined.
- Not only can the position and momentum of a single particle not simultaneously be measured to any desired accuracy; real systems do just not have sharply defined positions and momenta. For this reason quantum physics defines

If the world

- were deterministic and
- consisted exclusively of (interacting) particles,

if Newton's Law of Motion, $m \cdot b = K$, were valid without restriction,

if we knew

- all laws of nature, in particular all laws of force, and
- all boundary and initial conditions at a definite point in time (i.e., if Newton's laws apply, the positions and velocities of all particles)
- with absolute accuracy, and

if we could

- store all these data,
 - process them mathematically,
 - and solve all relevant equations
 - with sufficient speed,
- then not only would the course of the world be
- unambiguously determined (equal causes have equal effects)
 - in every detail,
- but then could we (or at least Laplace's demon, or a gigantic supercomputer) also
- calculate and determine all events
 - past and future.

Table 2: Preconditions and consequences of classical determinism.

the state of a particle differently than does classical physics. A measurement of a continuous parameter (such as position, time, speed) with absolute accuracy would mean the empirical determination of a real number, hence of an infinite number of decimal places. This cannot be achieved.

- Laplace knew, of course, that his premises of comprehensive data storage, data processing and speed of calculation could not be fulfilled by man. It was exactly for this reason that he introduced an intelligence with superhuman abilities. However, Laplace could still assume that all mathematical problems could be

solved by definable procedures, i. e., in the final analysis, by *algorithms*. Today we know that this assumption is erroneous. For some problems it has been shown that no algorithm for their solution exists. Moreover, for some perfectly realistic problems, solving methods are known, but to use them would demonstrably take too much time even for the cosmic supercomputer mentioned in Table 2. And no more elegant method of solution exists; in some cases this has been proved, in others it is highly probable.¹¹

— The principle of strong causality is not fulfilled. As shown by studies on chaotic systems, even *arbitrarily small* changes in the initial conditions can lead to incalculable deviations in later states. In such systems no reliable long-term predictions are possible, in spite of their deterministic structure (i. e. although *weak* causality obtains).¹²

— There are thus three developments in modern science which quite decisively call in question Laplace's demon, classical determinism, and thus our traditional search for order: quantum physics, theory of algorithms (metamathematics) and chaos theory. Many people will find this disappointing. Perhaps though, a world is indeed more human in which not everything is determined or calculable; a world in which, thanks to quantum events, there is chance and luck; in which, because not all problems are solvable by algorithms, imagination and inventiveness, guessing and trying, creativity and originality are still desired; and in which, as shown by chaos theory, it is still possible sensibly to search for simple basic laws, despite complex or even chaotic behaviour. In any case, the attempt to bring order into chaos can still be carried on for quite a long time. Perhaps we will attain in this way still an-

other, a fifth level of world view, one in which facts and moral norms *belong together* again as they do in myths, even though they cannot be derived from each other, as is usually assumed therein.

Do We Read Order into the World or Is It Already There?

Up to now we have been assuming that the order of which we are speaking is part of the world "out there" and totally independent of the perceiving subject. It may be difficult to discover, but it is there anyway. It is true, we experience this world only if we "look at it", i. e. if we interact with it. However, we believe that in this we gain insight into the world as it is even when we are not looking at it. We hope that the structures of the world can be found by us or at least be *reconstructed* in perception, experience and science.

This is nevertheless not obvious. The standpoint of the realist, which we have taken here, is not the only one possible. It is also possible to claim that the order discovered is present *not* in the external world, but, in the final analysis, in the subject, or that it is produced by her (possibly even by her alone). The structures of the world would then be invented rather than discovered. And our putative reconstructions would then in reality be only constructions, which had no or no recognizable relationship to the world.

The Contribution of the Subject

There are cases which support this possibility. Today we are convinced that the order described in myths is largely a product of the imagination. We therefore value and study them not so much because we expect from them clarification about the structure of the world, but be-

use they give us information about ourselves, our own past, the roots of our culture, our dreams, hopes and fears, about ideas and thoughts.

Even thinkers of antiquity attained the sight that the colours we seem to see in and on objects are not objective, but are subjective interpretations of outer signals. Similar considerations are valid for many other sensory qualities. Thus Democritus (c. 460 to 370) taught:

sweet and bitter, warm and cold, only exist in conventional opinion, equally so the colours of things). In reality only atoms and the void exist. (Fragment 9, cited by Sextus Empiricus)

Science too has revealed as subjective much that had been regarded as objective. John Locke (1632 to 1704) established this fact conceptually by his distinction between "primary" and "secondary" qualities.

However, it is not clear from the beginning which structures are objective and which subjective, which qualities are primary and which secondary. Would it be conceivable that, in the final analysis, all structures are due to the subject and thus subjective in this sense?

Everything Just a Construction?

The view that all structures in our perception derive from the perceiving subject and have nothing to do with the real world has a respectable philosophical tradition. Such a position can be ascribed to the theologian and philosopher George Berkeley (1684 to 1753). It was, however, worked out most precisely by Immanuel Kant (1724 to 1804) in his transcendental philosophy. Recently a similar position has been taken by Humberto Maturana, Francisco Varela, and others, with their "Radical Constructivism." According to

Kant, the object itself, and, according to Maturana, reality are not *perceivable*, and it is just superfluous to speak of something that cannot be perceived.

Others do not want to take up a position in this difficult question. They evaluate knowledge exclusively according to *pragmatic* criteria, particularly by the successes it achieves in mastering life. Scientific theories are seen by instrumentalists as nothing but instruments or tools. What they should provide is a precise and clear condensation of previous experience and reliable predictions of future events — and nothing else. There is no longer any talk of truth and error, of reality and appearance, or of objective and subjective contributions to cognition. For the instrumentalist, these are useless or even meaningless concepts.

An Argument for Realism: the Success of Theories

But is a statement senseless if it cannot be proved? Have we not one, or even several, *indirect* accesses to reality? Colours may be subjective interpretations, but, according to all we know, they are interpretations of something, namely, first of all of external signals which come from external objects. In comparison with mythic structures, the structures of perception are also much less arbitrary. They are comparatively stable and (ignoring colour blindness) also intersubjective: under the same conditions different observers have almost always the same perception of colour and they can usually reach agreement about the colour of an object. Colours thus may be subjective, but they are also intersubjective.

It is even more important that different signals correspond to different colours. To put it somewhat more carefully: Dif-

ferences in what is sensed can, as a rule, consistently and successfully be ascribed to objective differences; they can be explained or predicted by the latter. Even if the same water is perceived by the (pre-warmed) left hand as cold and by the (precooled) right hand as warm, we still find *objectifiable differences*, in this case at least in the past of the subject. The realistic, objectifying approach is in any case perfectly successful, both in everyday life and in science.

A Better Argument: the Failure of Theories

However, the *success* of realistic hypotheses is not the best argument for realism. The occasional *failure* of our hypotheses and theories is even more important. For what makes hypotheses fail? Instrumentalists, positivists, relativists, conventionalists, transcendentalists and radical constructivists have no convincing answer to this question. In contrast, the realist has a very simple and therefore illuminating explanation: hypotheses fail because they are *false*, because they do not describe the world correctly, because the structures which they postulate are not the structures of the world. It is true, fallacious theories can be successful in areas where their fallaciousness is irrelevant. Success is therefore no sufficient criterion of *truth*. However, what could cause the failure of a correct theory (or of a theory the correctness of which is irrelevant)? Failure is therefore a really good criterion for *fallaciousness*. And statements can be factually false only in relation to a real world, which happens to be different from what these statements maintain. The failure of descriptive hypotheses is therefore an even better argument for realism than is their success. This is but a reflection of

the asymmetry between verifiability and falsifiability so much stressed by modern philosophy of science.

Further Arguments for Realism

A further argument is the *convergence of research*. The values measured for a specified parameter seem to approach a "true" value — corrections apply to ever higher decimal places. Very often, different and quite independent methods of measurement lead to results agreeing with each other. Moreover, when different theories compete with each other, usually one of them turns out to be superior to all others. For the realist this is all just as it should be and as she would expect it; for the anti-realist it is and remains a riddle.

There are further arguments for realism, which we cannot all list here.¹³ Admittedly none of them is conclusive. There is simply no strict proof for the existence of the world, for its structuredness, for the correctness of our description. Not even the (fictional) radical solipsist, for whom his consciousness and that alone exists, is subject to logical, epistemological or empirical refutation. However, no one is really a solipsist, and, for the reasons just described, the position of hypothetical realism is not only permissible, but also reasonable. It is even the only *consistent* alternative to solipsism. And for the realist the search for order is a search for order in the world "out there".

¹ v. Weizsäcker, C. F.: The relevance of science. Collins, London 1964. Second Lecture. (German: Die Tragweite der Wissenschaft.) — ² Cf. entry "Chaos" in Ritter, J. (ed.): Historisches Wörterbuch der Philosophie (Historical dictionary of philosophy). Schwabe, Basel 1971. — ³ Lull, R.: Liber Chaos Opera III. Mainz 1722; Frankfurt 1965, p. 250.

⁴ Grant, E.: Much ado about nothing. Theories of space and vacuum from the middle ages to the scien-

revolution. Cambridge University Press 1981. — ⁵ *Royer, T. H.*: The classical vacuum; *Scientific American* 253 (Aug. 1985), 56 to 62. — *Aitchison, I. J. R.*: Nothing's plenty: The vacuum in modern quantum theory. *Contemp. Physics* 26 (1985), 333 to 391. — *Refelski, J./Müller, B.*: The structured vacuum: looking about nothing. *Internat. Publ. Service, Göttingen (Ma.)* 1985. — ⁶ *Greiner, W.*: Ist das Vakuum wirklich leer? (Is the vacuum really empty?) *Steiner, Freiburg 1980*. — ⁷ *Eliade, M.* (ed.): *La naissance du monde*. Editions du Seuil, Paris 1964 (preface by Eliade). — ⁸ *Ibid.* — ⁹ *Munitz, M. K.* (ed.): Theories of the universe. From Babylonian myth to modern science. Allen & Unwin, London 1957. — *Toulmin, S./Goodfield, J.*: The fabric of the heavens. Hutchinson Educational, London 1961. — *Sticker, B.*: Bau und Bildung des Weltalls (Structure and formation of the universe). Herder, Freiburg 1967. — *Charon, J.*: Cosmology. Weidenfeld & Nicolson, London 1970 (also French and German). — ¹⁰ *de Laplace, P. S.*: A

philosophical essay on probabilities (French 1814, p. 3 f.) — ¹¹ *Stockmeyer, L. J./Chandra, A. K.*: Intrinsically difficult problems. *Scientific American* 240 (May 1979), 124 to 133. — *Wolfram, S.*: Undecidability and intractability in theoretical physics. *Physical Review Letters* 54 (1985), 735 to 738. — ¹² The problems of weak causality, which allows chaotic behaviour even without quantum physics, were hinted at by Henri Poincaré, but rediscovered by Max Born. They became part of general scientific knowledge only a few years ago. See *Born, M.*: Voraussagbarkeit in der Klassischen Mechanik (Predictability in classical mechanics). *Physikalische Blätter* 15 (1959), 342 to 349. — *Deker, U./Thomas, H.*: Unberechenbares Spiel der Natur: Die Chaos-Theorie. *Bild der Wissenschaft*, Jan. 1983, 62 to 75. — ¹³ The arguments for realism are collected in *Vollmer, G.*: Against Instrumentalism. In: *P. Weingartner/G. J. W. Dorn* (eds.): Studies on Mario Bunge's *Treatise*. Rodopi, Amsterdam 1990, 245 to 259.

Self-organization in Complex Systems

Bernulf Kanitscheider, Giessen

*For want of a nail the shoe was lost.
 For want of a shoe the horse was lost.
 For want of the horse the rider was lost.
 For want of the rider the battle was lost.
 For want of the battle the kingdom was lost.
 And all for want of a horseshoe nail.*

Benjamin Franklin, Poor Richard, 1758

It is characteristic of complex phenomena that a great number of partial systems work together, be they macroscopic solids, combination of cells, or social systems: everywhere there is a cooperation of many elements. The crucial factor of collective order is the nonlinear dynamics of these processes. From it a new kind of bridge can be derived between the material sphere of physics and the living systems, including their cooperative phenomena. The evidence becomes more and more compelling that biological and socio-cultural orders merely constitute different realizations of the same basic patterns of nature. To comprehend this, however, the domain of classical physics must be transcended.

The Mechanistic World View

Time and again, people have thought about what place man and his intellectual activity take up in the world as it is described by natural science. Traditionally, the rational animal seemed to match poorly with the realm of the material.

Many traditional philosophers have therefore stressed that matter, life and mind belong in principle to different domains, that they have little in common and –

Prof. Dr. Bernulf Kanitscheider was born in Hamburg in 1939. He received his Ph. D. in 1964 in Innsbruck for his dissertation on "The Problem of Consciousness." In 1970 he received his "habilitation" in philosophy at the

University of Innsbruck for a treatise on "Geometry and Reality." In 1974 he took over the newly created chair for philosophy of science at the University of Giessen (Centre for Philosophy and the Foundations of Science). His most recent publications: "Wissenschaftstheorie der Naturwissenschaft" ('The Scientific Theory of the Natural Sciences'), Berlin, 1981; "Das Weltbild Albert Einsteins. Seine Physik und seine Philosophie" ('Albert Einstein's View of the World: His Physics and His Philosophy'), Munich, 1988; "Von der mechanistischen Welt zum kreativen Universum" ('From a Clock-World to a Creative Universe'), Darmstadt 1993.



Prof. Dr. Bernulf Kanitscheider, Zentrum für Philosophie und Grundlagen der Wissenschaft, Justus-Liebig-Universität Giessen, Otto-Behaghel-Strasse 10/C, D-6300 Giessen

structurally and materially — are to be located to essentially different ontologies. Today we understand the reasons for his attitude much better. The deep chasm which seems to predominate between the field of dead matter, the living, and the mental sphere is explained at least in part by the type of physics which evolved in the 18th and 19th centuries.¹

The paragon for every theory in this was Newton's mechanics. This theory was further developed by eminent mathematicians such as Laplace, Lagrange, and Hamilton up to a highly powerful instrument. Particularly, in the field of celestial mechanics the sophisticated perturbation theory was elaborated and applying it to many more peculiar systems, such amazing successes were achieved that the fundamental metaphysical assumption became plausible that the universe is structured on all layers of reality in accordance with mechanistic principles. The mechanistic world view even guided the theorist's heuristics when new kinds of phenomena came to the fore. This happened in the 19th century, when electrodynamics and thermodynamics took their places alongside of classical physics. For the electromagnetic field and the medium of propagation for the light waves, the ether, it was James Clark Maxwell who tried to find mechanical models. For the irreversible processes of thermodynamics Ludwig Boltzmann proposed an explanation using statistical mechanics. Taking mechanism to its extreme, Pierre Simon de Laplace pronounced the program of the mechanical explication of nature as the ultimate goal of science. He defended the vision that in Newton's mechanics we already possess the true, unsurpassable pattern of the laws of nature. To be sure, it was still the task of science to discover the pertinent forces at work in matter, but

if these are determined empirically, the universal laws of motion were the source of all description of possible changes in nature. According to Laplace, the world is a mechanical clock, the structure of the laws of which are known, and man, too, with his mental abilities could ultimately, i.e., if we had sufficient empirical knowledge on the forces applying to this domain, be comprehended in a causal and mechanistic way.²

Chance acts a crucial role in this world view. Laplace knew, of course, like all his contemporaries, that celestial mechanics is a particularly ideal instance of science which in the course of events is determined by a small number of well defined parameters. In terrestrial physics, the variety of determining causes of the events, however, is so great and so involved that the perfection of the astronomical prediction can never be achieved. Chance in regard to complex phenomena roots in human ignorance of the true causes. Variegated complexity and entangled causal structure require the use of probability to grasp them. Thus the shortcoming and finiteness of the human intellect force the category of probability on us. On the level of objective reality, however, chance is inappropriate within the explanatory scheme of classical mechanics. The course of events is determined according to pull and push by the laws of mechanics.³

No wonder that the humanities did not know what to make of this view of man as a special machine, since keeping with the received concept of human freedom, they were convinced that in the deterministic course of events, to which ultimately also man is subjected, there is no place for free decisions and thus for true morality. Since the mechanistic world view apparently lacked a natural place for

morality, it seemed to be incomplete in a fundamental sense. Thus, in regard to the nature of man there opened a great divide between the scientific and the philosophical perspective.

The Role of Chance

History of science often shows that if a new idea appears on the scene, it must not only be uttered, it must also be understood by the audience and bolstered by the intellectual community. In 1903 Henri Poincaré pointed out a crucial difference in the running of mechanical systems: even for a deterministic system we can know its initial state only approximately. If we can then predict its final state with equal approximation, this is a particularly fortunate case. But occasionally, small differences in the initial conditions may cause very large changes in the final states. If this happens, prediction becomes impossible, and we are faced with a situation tantamount to chance.⁴ At that time nobody understood the importance of Poincaré's differentiation, which we refer to today using the terms strong and weak causality.

The role of chance in physics was reflected again only when quantum mechanics arrived on the scene. The Heisenberg scattering relations, which are the result of the noncommutability of certain dynamic variables, introduced chance to the level of law, as well. Primarily, quantum mechanics was constructed as a theory dealing with the atomic constituents of matter. It was a theory of the very small; its transference to fields then led to the theories of elementary particles and high-energy physics. Thus, modern physics steered for two fields of investigation: quantum mechanics moved towards the world of the very small, the theory of

relativity towards the global structure of the world, the cosmos as a whole. In both areas great successes were achieved. With the aid of the formalism of quantum-field theory, the energy levels of atoms and nuclei could be calculated with uttermost precision; the cosmological models of the general theory of relativity met outstanding astrophysical corroboration. However, until recently one area remained a stranger to the world of physics: medium sized objects with their confusingly multifarious properties, in short, the realm of the complex. The status of knowledge in this field had been assessed wrongly for a long time. Complexity was regarded as an unfathomable intricate superposition of many processes each of which taken by itself is simple. So it were only for pragmatic reasons that one couldn't prognosticate exactly the behaviour and development of complex systems. This opinion which is considered erroneous today, can be nicely illustrated by the classic example of a complex structure, the movement of a fluid. For very special boundary conditions the motion of water in a river is predictable and can be deduced from the equations – this is true when the movement is steady, smooth, and free of turbulence and thus laminar. Under most conditions which occur in reality, however, it is eddied, discontinuous, foamy: turbulent, in short. A mountain brook, despite stationary boulders and a constant amount of water, displays incidental behaviour which cannot be deduced from the fundamental equations. For a long time the chance movement of a turbulent fluid was explained as a superposition of many independent oscillations. A higher degree of turbulence – more whitecaps in the mountain brook – accordingly signifies an interaction of a greater number of oscillations, each of

ture of
hole. In
achieved.
of quan-
levels of
ated with
nological
relativity
orrobora-
the area re-
of phys-
their con-
in short,
status of
assessed
cricate su-
each of
o it were
that one
e behav-
plex sys-
considered
llustrated
lex struc-
For very
e motion
and can
— this is
steady,
and thus
s which
died, dis-
short. A
ary boul-
ater, dis-
n cannot
tal equa-
ce move-
lained as
dent os-
rbulence
in brook
tion of a
each of
em having a simple, calculable struc-
ture.

This early hypothesis on the origin of incidental behaviour in deterministic systems proved to be untenable. Soon examples were found of simple mechanical systems, such as certain pendulum movements, which displayed incidental behaviour for a wide range of boundary conditions.⁵ It was found that the time development of some very simple systems was so sensitively dependent on their initial conditions, that even the smallest variation of the initial state caused the system to reach completely different final state. The behaviour of deterministic systems, when the pertinent solutions of the dynamic equations depend with extreme sensitivity on the choice of the initial conditions, is called *chaotic*.⁶ If a system displays an exponential divergence of initially closely adjacent trajectories, this local instability of motion precludes the calculation of long-term behaviour. The equations of motion resulting in chaos are in each case nonlinear, which means that the following principle of order in describing nature is definitely no longer applicable here:⁷ if a natural event can occur in the form $x_1(t)$ and in the form $x_2(t)$, the additive combination $x_1(t) + x_2(t)$ is a possible process in nature. This is called linearity. Linearity implies the applicability of superposing physical states, and this leads to a certain causal structure. Then not only the weak causal principle applies ("equal causes lead to equal effects") but also the strong causal principle is valid ("similar causes lead to similar effects"). In nonlinear systems the strong causal principle loses its validity; therefore unpredictability and chaos can occur. Incalculability in a fundamental sense is the result. It has nothing to do with pragmatic-technical obstacles to computation stemming from

man's shortcomings, but derives from intrasystematic traits which hamper prediction.

However, chaos has several consequences which are definitely not all negative in the sense that they restrict our possibilities of knowledge:

— The basic nonlinearity of the chaotic processes gives rise to a new kind of geometry, in which selfsimilarity is the crucial property instead of superposition. For this geometry Benoît Mandelbrot coined the term *fractal*.⁸ The very existence of such a mathematical structure testifies that even chaotic states can be comprehended in principle. Nevertheless, chaos limits in a way the ascertainment of the asymptotic future development of nonlinear systems; thus we encounter a new source of chance even in classical deterministic processes.

— The feature of nonlinearity in chaotic systems engenders the formation of order. This consequence of chaos is of greatest epistemological importance as it leads to the comprehensibility even of complex systems, a fact which defies any apparent new limits of scientific rationality. Complexity is ubiquitous. It is characteristic of complex phenomena that a great number of partial systems work together, be they macroscopic solids, aggregations of cells, or social systems: everywhere we encounter a cooperation of many elements. The crucial factor of collective order is the nonlinear dynamics of these processes. From it a new kind of bridge can be established between the material sphere of physics and the domain of living systems including those cooperative phenomena, which pertain to consciousness, intelligence and knowledge.

Precisely from a philosophical perspective it is important to point out the two-fold significance of chaotic states of cer-

tain dynamic systems. On the one hand we must ascertain a further instance of incidental causality in nature which limits Laplace's calculability of the universe to a very small partial class of systems — this can be called the *destructive meaning of chaos*. It shows up particularly when the long-term behaviour of dynamic systems is characterized by a strange attractor, which means that the development of the system in the state space can no longer be represented by a simple geometric form such as a fixed point, a limit cycle or a torus, but by a strange self similar configuration with the geometrical structure of a fractal.

An ordinary pendulum familiar in physics whose oscillations are damped by a force at the point of suspension develops towards a fixed final position, regardless of where it is started. Here the attractor is a fixed point. An undamped mathematical pendulum moves permanently on a closed curve in the state space. The attractor is a limit cycle. The heartbeat of a living being such as a mammal exhibits a somewhat more complicated and yet unambiguous final configuration in the state space: the attractor is a torus.

When a strange attractor characterizes the dynamics of a system its behaviour is not determined by a fixed final state, but by a complicated self similar configuration in the state space involving a steadily increasing intertwining of the trajectories. The strange attractor, which, as indicated above, has the geometry of a fractal, gained publicity through the meteorologist Edward Lorenz, when he discovered that geometrical structure in equations with which he modelled the unpredictable behaviour of the weather.⁹ He found that the many failures in the attempts to make long-term prognoses concerning the development of atmospheric state

were due to the system and not to human ignorance. A dynamic system having a strange attractor destroys the original information characterizing its initial state in that its trajectories, or paths, undergo rapid plication. This intermixing of widely divergent trajectories magnifies microscopic fluctuations and spreads them over the entire state space to such an extent, that very soon the causal connection of past and future is lost. The destructive role of chaos thus brings about fundamental change in the epistemological situation. Not temporary ignorance or experimental limitations are responsible for limited pursuitability of chaotic processes, but the intrinsic structure of the chaotic system itself. The occurrence of the chaotic strange attractors also changes the traditional reductionistic strategy of understanding a system out of its parts and their mutual relationships. If the interaction of the components is nonlinear breaking down the whole into its parts and reconstructing the global behaviour of the system is at least much more difficult, if not impossible.¹⁰

On the other hand, far too little emphasis is laid on the fact that there is also constructive significance of chaos in nature. The magnifying of small oscillations in certain dynamic variables to macroscopic dimensions provides a mechanism which induces new qualitative changes in nature. It is precisely by including the constructive function of chaos, the morphogenetic, structure-forming role, which takes us beyond the realm of inanimate nature.

Chaos and Complexity in Society

Friedrich von Hayek has convincingly shown that even the free market constitutes a spontaneous order which has been

ought about by nonlocal (decentralized) actions of many individuals, where the market contains much more information than an individual could ever possibly take up. The free market economy is thus spontaneously created complex order, based, admittedly, on the purposive activation of the elements of this order, but it is itself not purposeful and thus cannot be changed by implementing a plan. The market links the actions and goals of the individual people to form an ordered whole. However, the entire system develops in a direction which nobody can predict, because the knowledge which is distributed in the system and maintains the chaotic order in it far exceeds the mental capacity of the individual. From this follows obviously, that when, despite these intrinsic properties of the system, an individual or the group tries to control the social order according to a plan, he must drastically reduce the complexity of the system, because this individual person can only employ his own much lesser knowledge in planning of changes.

In this way the realization of the complexity of our social order also suggests distinct normative perspectives for our action in society. The connection with the normative level should of course not be taken in the deductive sense, as otherwise a conflict would arise with the logically impenetrable barrier of "is" and "ought". Social norms can never be derived from empirical assertions alone. The existence of certain norms can be explained from a descriptive context containing value assertions, but this very context cannot be used to justify those rules of conduct. However, when introducing norms in a society it should not be forgotten that empirical populations possess an intrinsic value structure which the establishment of norms must take into account if we

want to achieve a sufficient acceptance of the norm. In this case it is the intrinsic structure of the complex system, society, which forces limitations on its planned control.¹² The impossibility of social planning is an epistemological impossibility.

A global design of the development of the entire social system is thus unfeasible, because the necessary theoretical knowledge which could replace the practical knowledge of all the individuals in particular individual acting will never be available.

It is thus not for psychological reasons that the citizen doesn't behave more altruistically towards his fellow men. Even if every individual person thought of his neighbour when acting as a consumer, planning still wouldn't work, because it would be impossible to comprise all these interactions within a theoretical model apt for global design. The essence of liberalistic political economy can be comprehended from the complexity of the social system. Because the complex order surpasses everything which conscious organization could have produced, it is wrong to maintain that we must consciously plan modern society, because it has become so complex.

Not only Friedrich von Hayek, the classic of the Austrian school of economics, but also other economists such as James Buchanan have repeatedly stressed, that the high degree of order in our liberal social system can be preserved if we don't destabilize this order by "social engineering."¹³ The freedom of the individual, the minimal restriction of his spontaneous decisions and the complex order are in a mutually supportive relationship. Remarkable from the philosophical point of view is the concatenation of dynamics, complex order, and freedom. A guarantor of freedom is the utilization of the spon-

taneity of the ordering forces. The knowledge and skills of all the members of society are best utilized, if their freedom of action is not restricted and if they are not subjected to central control designed to guide the development of society according to a predetermined catalogue of goals. It would be a great mistake to believe that this connection only concerns economic freedom. From political experience we know very well that all freedoms are interconnected. "Freedom is one whole," Milton Friedman wrote already ten years ago, "anything that reduces freedom in one part of our lives is likely to affect freedom in other parts."¹⁴

Arguments on the complexity of order go still further and also affect, for example, such politically sensitive areas as the dispersal of income. According to classic liberalist economics it is not the task of the government to interfere in the process of establishing large-scale social order, because this order cannot be planned and calculated. Therefore the state is not allowed to intervene in the way the market distributes goods among individual people. Fairness of distribution, as advocated by the defenders of social market economy, isn't even defined in a free-market economy.¹⁵ The concept of fair distribution of income can only be applied in a purposively organized society which, however, being less complex, has a lesser degree of economic efficacy, too.

In a self-organizing social order, nobody distributes income, neither fairly nor unfairly. The dispersal of income is a result of the spontaneous ordering forces.¹⁶

Man in the World of Physics

I have treated this economic example at somewhat greater length because it seems

to be an extremely remarkable intellectual development, that the role of man and his social functions are focussed convergently from two opposite directions – from the viewpoint of political economy and the systems theory of the natural sciences. In order to attain this goal we have to take in consideration transcending thereby classical domains of physics – theories on fluctuations, instabilities, bifurcations, cooperations, and the nonlocal collaboration of elements within the system (synergetics) to grasp the phenomena of order, complexity, and qualitative diversification.

From a philosophical standpoint the convergence of explanatory schemes of the "two cultures" (Peter Snow) has acquitted the problem of reduction with its traditionally strong emotional overtones, and its piquancy. Man, with his socio-cultural idiosyncrasies, is not simply a special case of physics; he is not just a difficult calculation problem like – say – the precise solution of the Schrödinger equation for an iron atom, but complex systems with their own intrinsic degrees of freedom and nonlinear dynamics in their interactions are part of a thermodynamic regime in its own right. In spite of their peculiarity, living, neuronal and social systems are not exceptions to the laws of nature, which only function, because special vital forces and spiritual agents transcend the laws of physics. The realm of the living is compatible with the laws of physics if due attention is given to the particularity of the nonequilibrium and to the nonlinearity of the pertinent physical situation. The contrast in the realm of nature between matter, life and mind is thus an artifact which only got apparent, because unsuitable laws of nature were referred to. For this reasons too the idea of evolution, which originated in the 19th

tellectual n and his vergently from the and the ences. In e to take thereby eories on urcations, collabora m (syner- of order, iversifica- point the schemes of) has ac- n with its vertones, socio-cul- a spe- st a diff- say - the ger equa- plex sys- degrees of in their hydrodynamic e of their d social e laws of cause spe- ents tran- realm of e laws of n to the m and to physical lm of na- d is thus were re- e idea of the 19th century, was given seemingly opposing interpretations. Irreversibility and evolution in the sense of physics, discovered by Carnot and Clausius, were always associated with the dissolution of structures, whereas biological and sociological evolution — as explained by Darwin and Spencer — were from the beginning linked to the growth of complexity. It is remarkable that the contrast between the evolution of the inorganic and organic spheres is resolved only recently. In Jacques Monod's famous book "Chance and Necessity" life — and accordingly mankind as well — is still regarded as the outcome of extremely improbable initial conditions.¹⁷ Life is presumably compatible with the laws of physics in Monod's approach, but simply because the initial conditions are only postulations which are as a rule considered to be unfathomable. But life cannot be inferred from the laws of physics according to Monod's approach, for they are not concerned with initial conditions with the possible exception of cosmology.

From the viewpoint of nonequilibrium thermodynamics and synergetics, as well, living processes are by no means apart from nature; on the contrary, they follow from those laws of nature specifying the corresponding nonlinear interactions and conditions far away from equilibrium. This enables functional and structural order to be understood as being in accordance with natural laws. It should be stressed however that the evolution of structural hierarchy, which we observe in nature is achieved in many small steps. If by increasing energy flow a system moves further and further away from equilibrium, a single solution can bifurcate to a multiplicity of solutions. Macroscopic living structures such as man have undergone of course many bifurcations; accord-

ingly, the functional order of a living being such as man has an autonomy, which is in seeming contradiction to the laws of physics. Macroscopic structures which lie at the far end of a hierarchy of ramifications or catastrophes have such a high structural and functional idiosyncrasy that we may be led to the erroneous assumption that they are something apart from nature. This illusion may be the origin of dualistic theories about the nature of the human mind as proposed by Descartes or Kant, for example. From the dualistic theories on the nature of man we can draw a methodological moral: knowledge becomes particularly difficult when the cognitive system is too close to the subject of investigation. Even physics itself encounters this difficulty. Until recently, astronomers met great difficulties in recognizing the true structure of our Milky Way, because we are in the midst of this galaxy. The spiral structure of the Andromeda nebula, however, is easily recognizable from any good photograph. In our own galaxy, in contrast, we must deduce the correct structure using high theoretical abstraction and very indirect methods. The same methodological obstacle applies to nature of man, as well. The immediate impression of our self and of our fellowmen blocks our view and distorts the picture. Noncognitive evaluating interest precludes objectifying abstraction. Man is too much involved when his own nature is at stake. It is very conducive to objectivity, if he views himself from some distance, particularly embedding his own existence in a larger natural context. This is precisely what the system-theoretical perspective does: it exposes the difference and sameness of natural objects. In that way, the philosophical dualistic views which are incomprehensible from the evolutionary standpoint can be avoided.

If a *mundus sensibilis* and a *mundus intelligibilis* (Kant) or a *res extensa* and a *res cogitans* (Descartes), matter and mind for short, exist alongside and unrelated to one another from the beginning, an ontological scheme of this kind cannot be comprehended using the principle of evolution. In an integrated understanding of man, we must bring his particularities into a *causal* relationship with nature. This is now possible using modern theories on the origin of structures. One need no longer enlist an army of Maxwellian demons to prevent a physical system from undergoing transition to a state of maximum disorder. If the right thermodynamic situation is given, the system develops all those particularities which have so often led traditional philosophers to remove man from the entirety of nature and place him, as alien to nature, in opposition to it. However, the new theories of self-organization establish bridges spanning the entire sphere of the living, including its mental and social activities. Such a theory has not only an explanatory task, it also reduces the peculiar strangeness of man, which he has always experienced in the face of inanimate material nature. To overcome this gap can be called the philosophical function of the idea of self-organization. As late as 1970, Jacques Monod coined the image of man as a gypsy at the edge of the universe, an illustration of his absolute incidental nature and the lack of lawful connections between man and the universe. In recent times science discovered further hints that man is rather to be regarded as an expression of the high creative force of our special universe, which is capable of building up complexity, at least for long periods.¹⁸ This structural growth occurs in accord with laws and is therefore comprehensible by human knowledge.

Chance of course is involved, but it is capitalized by the selection of environment, which acts in a lawful way. In any case, science can teach us to estimate man in the correct relation to the universe. Although there are no good reasons that man regards himself as the center of the universe, he is quite right to be astonished of his existence at all.

¹ Dijksterhuis, E. J.: Die Mechanisierung unseres Weltbildes. In: Phys. Blätter. 12 (1956), p. 481–494.

² de Laplace, P. S.: Philosophischer Versuch über die Wahrscheinlichkeiten. Leipzig 1886. — ³ Merleau-Ponty, J.: Der Mechanismus – Blüte und Niedergang einer Naturphilosophie. In: B. Kanitscheider (ed.): Moderne Naturphilosophie. Würzburg 1984. p. 127–140. — ⁴ Poicaré, H.: Wissenschaft und Methode. Leipzig/Berlin 1914. p. 57. — ⁵ Even in the field of celestial mechanics bodies with such unstable trajectories have been discovered. Cf. Baier, W.: Chaoten im Sonnensystem. In: Sterne und Weltraum 28 (1989), p. 416. — ⁶ Sexl, R. U.: Order and Chaos. In: G. Radnitzky (ed.): Centripetal Forces in the Sciences II. New York 1988. p. 144–156. — ⁷ Großmann, S.: Selbstähnlichkeit: Das Strukturgesetz im und vor dem Chaos. In: Phys. Blätter. 45 (1989), p. 172–180.

⁸ Mandelbrot, B.: The Fractal Geometry of Nature. San Francisco 1982. — ⁹ Lorenz, E. N.: Deterministic Nonperiodic Flow. In: Journ. of the Atmospheric Sciences 20 (1963), p. 130–141. — ¹⁰ Hedrich, R.: Komplexe und fundamentale Strukturen – Grenzen des Reduktionismus. Mannheim 1990. — ¹¹ v. Hayek, F.: The Theory of Complex Phenomena. In: M. Bunge (ed.): The Critical Approach to Science and Philosophy. New York 1964. — ¹² Kanitscheider, B.: Soziobiologie und Ethik. In: E. Braun (ed.): Wissenschaft und Ethik. Bern/Frankfurt/M./New York 1986. p. 81–116. — ¹³ Buchanan, J. M.: Die Grenzen der Freiheit. Tübingen 1984. p. 130. — ¹⁴ Friedmann, M. und R.: Free to Choose: A Personal Statement. London 1980. p. 69. — ¹⁵ v. Hayek, F.: Grundsätze einer liberalen Gesellschaftsordnung. In: F. v. Hayek: Freiburger Studien. Tübingen 1969. p. 108–125. — ¹⁶ Radnitzky, G.: Soziale oder Freie Marktwirtschaft? In: Neue Zürcher Zeitung (May 26, 1990), p. 93 ff. — ¹⁷ Monod, J.: Le hasard et la nécessité: essai sur la philosophie naturelle de la biologie moderne. Paris 1970. p. 187–188. — ¹⁸ Kanitscheider, B.: Von der mechanistischen Welt zum kreativen Universum. Wissenschaftliche Buchgesellschaft. Darmstadt 1993.

The Dictatorship of the Right Angle

The Geometrification of Our Realities

Hans-Peter Schwöbel, Mannheim

geometric shapes display certain aesthetic characteristics. They are simple, clear, exact, regular, abstract, adaptable, repeatable, and transposable. These characteristics have resulted in a wealth of eminently significant cultural functions. With the aid of geometry, we can analyse and synthesize, calculate, project and construct, plan, organize, administer, control, systematize and model, compare, standardize, archive, and communicate.

Geometry has proven to be one of the mainstays of all civilizations, without which central economic, social, and technological processes could not be organized (architecture, city and transportation planning, etc.). In pre-agrarian societies, geometry was of course of slight significance (at most now and then in the context of religiously motivated exploration and projects). In agrarian societies, planning and projecting were done with the aid of geometry in special cases (e.g., in building artificial irrigation systems). In general, however, this occurred only rarely even in agricultural production. In contrast, it was and is important in all societies in which the beginnings of urban development occur. Geometry, like mathematics on the whole and writing in particular, is part of the urbanization of man.

But the aesthetics of elementary geometry was not truly unleashed until the industrial age. The enormous productivity of industrial-production methods would be inconceivable without the pervasive application of geometrical principles and forms.

This grandiose success as a constitutive factor of industrial-production methods, however, has been accompanied in recent history and to the present day an increasingly *hypertrophic spread of geometric aesthetics*. What was once a valuable aid in orientation and planning in specific fields, took on dynamics of its own and is now overrunning all competitors.

In architecture, urban planning, agriculture, and landscape planning, parts of elementary geometry were transformed

Prof. Dr. Hans-Peter Schwöbel, born in 1945. Poet, cabaret artist, essayist; professor of sociology in Mannheim. Apart from his books, Schwöbel publishes regularly in magazines, newspapers, radio, and television.



Prof. Dr. Hans-Peter Schwöbel,
Seckacher Strasse 68, D-6800 Mannheim 51

from instruments for calculation, planning, and projection into models which were pre-ordained for the spatial and aesthetic organization of reality directly, in untranslated form, as it were. The multitude of possibilities which elementary geometry definitely had to offer was sharply reduced in the process. Indeed, we can speak of an aesthetic dictatorship of straight lines, the right angle, squares, rectangles, grids, extremely smooth surfaces (glass, steel, concrete), cubic forms, and exact, thousandfold repeated symmetries.

From Paris to Vladivostok, cities were blessed with satellite communities resulting in a never-before-seen uniformity and desolation of the visual environment. In other parts of the globe, similar things can be observed at other points in time. Villages and unsettled landscapes were simultaneously cleared, levelled, smoothed over, made precise, and blocked out.

Economics and Aesthetics

Economic forces are correctly deemed responsible for these processes. These energies are complex and act interdependently and together with non-economic factors.

Since Europe emerged from the Middle Ages, this continent, and in the course of time the whole world, has been under a compelling necessity for modernization. This modernization took place and continues to take place worldwide non-simultaneously, but with increasing acceleration and more and more comprehensively; no culture and no sphere of living have remained unaffected. On the political and military plane, this is accomplished as a rule by the formation of regional and national predominance of cer-

tain countries over others (e. g., European colonialism, later the predominance of the U.S.A.). The nucleus of the project of modernization is the increase of production, distribution, and communications efficiency; in short: development of higher-performance models and processes of society. Important aspects of this modernization are the industrial-production method and fiercely competing systems of political organization, collective identity, conflict and consensus production, gaining legitimacy – fascist, Stalinist, and democratic systems, to name but a few particularly important examples.

The fascist and Stalinist models were utter failures, among other reasons because they were also no match for objective modernization pressure as regards the complexity and dynamics of social transformation (ideals, power structures, institutions). We can categorize fascism and Stalinism as reactionary modernization strategies which defined daemonic and sinister aspects of modernity in the manner of surrealistic films. The KGB, the "Stasi", and Gestapo are distorted, grimacing likenesses of the idea of the Enlightenment.

There is a multitude of factors exerting modernization pressure and intensifying it by mutual correlation. To mention one important aspect briefly here: for several centuries a rapid growth of the population has been registered which is accelerating further worldwide and is leading to a hitherto unknown population and communications density. This development necessitates modernization of organizational processes as regards time and space, and here *elementary geometry, aesthetics' shortest route*, is clearly superior to other solutions. Moreover, industrial-production methods, involving enormous

amounts of resources and capital, contain intrinsic systematic pressures for continuous modernization.

However, these economic impetuses do not go on unchecked. In societies which are most advanced in regard to their historically discernible modernization tendencies, those aspects which are oriented towards geometrical aesthetics — agro-industry, landscape and urban planning, organization of production and consumption, as well as of transportation — have fallen into a state of grave crisis. This crisis is extremely dangerous for the whole world. At the same time it forms the basis for the hope that the project of modernization could be re-formulated and continued in an altered form.

What are the main economic factors enabling a re-formulation of the moderni-

zation project to be made and necessitating it?

1. The production efficiency of modern industrial societies has by now been increased to the point (the average productivity of one work-hour trebled in the Federal Republic of Germany (West) between 1960 and 1990), that for years, in nearly all sectors of agro-industrial and industrial production, huge surpluses have been resulting whose utilization, storage, or intentional destruction involve high costs which wipe out the cost benefits of conventional production methods.

2. Subsequently, grave, cost-intensive damage is found to result from the unrelenting, all-pervasive classical production methods. On the basis of geometrically organized monocultures (geometrification of the landscape and production in mono-



(Photo: Bilderdienst Süddeutscher Verlag)

cultures are Siamese twins), the following damage primarily occurs:

- worldwide sealing off and erosion of soil to a hitherto unknown extent,
- extreme susceptibility to disruptions of all monocultures, in regard to natural, social, political, and economic impairments,
- pollution and destruction of large tracts of land by overcapitalization and overproduction,
- a dramatic decrease in the diversity of species of flora and fauna, with acute and chronic destruction of the genetic and aesthetic potential of the earth; increase of epidemic disease of plants, animals, humankind, and soils,
- the automobile has significantly contributed to the geometrification of the landscape.

3. For some years, a further profound revolution of production technology has been taking place which allows us to hope that the clumsy, extremely rough, dirty, and noisy industrial technology of the last 200 years can be supplanted.

This stenogramme of changed economic conditions makes it clear, it seems to me, that for reasons of economics, it is neither necessary nor possible to continue or indeed expand production, distribution, and consumption as grids of monocultures. Everything which is undertaken in the old direction only brings us nearer to the abyss economically, as well.

Boiled vs. Raw: Aesthetics and Civilization

Economic driving forces prove to be a necessary but by no means sufficient explanation for the rapid and pervasive spread of geometry in all spheres of life. Moreover, there are subtle individual and

collective cultural psychological factors which are no less significant.

We Europeans, and we Germans even more than most of our neighbours, think of cultivation of the world (even self-cultivation!) as a struggle to overcome and even *destroy the wilderness*. It is the struggle of the boiled versus the raw, of the smooth versus the rough, the straight versus the crooked, the closed versus the open, the definitely completed versus what is coming to be, the planned versus the spontaneous, the refined versus the naturally unmanipulated.

There is no cultural sphere in the world which exterminated the jungles and other wild terrains, including the wildlife living there, as early and as thoroughly as Christian-occidental civilization. This can in no way be sufficiently explained by population density. Until some 250 years ago, Europe was no more densely populated than other regions.

Whereas the dignity of nature was protected by religious taboos in other cultures, in our sphere there was a tradition rooted in religion and philosophy to view nature with contempt, which Descartes, for one, summed up by claiming that animals are machines without souls.

A further aggravation of this trend occurred in the context of colonialism, when Europeans encountered cultures whose attitude towards the wilderness was less rigorous, more prone to compromise, and integrative than their own. On the basis of religious interpretations as well as everyday traditions, large cultures in Africa, parts of Asia, and on both American continents had succeeded in reaching the particular cultural achievement of an admirable balance between culture and the wilderness.¹

To avoid possible misunderstandings: culture is the opposite of the wilderness.



campaign against nature: railroad construction in the German colony of Togo; photograph, 1895.

(Photo: Archiv für Kunst und Geschichte)

is the inventing/invented, planning/unplanned; it is the artificially creating/created. Primitive peoples are also not referred to (in German) as "natural" peoples because they are an unadulterated part of nature. "Natural" peoples are cultural peoples. The particular thing about their *cultural* achievement lies in the fact that they not only adapt their natural environment to themselves, but they adapt their natural environment, as well. But there is a great difference between whether culture is achieved in a campaign of destruction of nature or whether it is capable of compromise, of a kind of productive co-existence with the wilderness. As the encounter with the strange cultures was not subjected to critical thought, it served to further stabilize the

anti-nature traditions, so as not to jeopardize the feeling of superiority and missionary zeal. The campaign against nature was continued in the "new worlds," even though these worlds were even long after the conquest of the Europeans by no means overpopulated.

The counterargument is justified that in our day population pressure and the effects of Western modernization models in countries of the (former) Second and Third Worlds have by now become too strong for us to expect old traditions to be capable of constituting a consciousness which can integrate the new given conditions *on the basis of reason* and to the benefit of mankind. Objectively speaking, the traditions would have to seem reactionary in the face of the crush-

ing weight of the new. As we can observe from many examples, this risk exists. The solution, in my opinion, is not to arrive at a decision exclusively favouring scientific enlightenment, on the one hand, over everyday awareness and religious-interpretation systems, on the other. On the contrary, we must get over the idea that these forms of consciousness are irreconcilably hostile towards one another. Modern science has long got over the complacent self-prejudice that it is the sole legitimate interpreter of the world, claiming the definitive validity of its statements. It has recognized its status as a series of processes and systems of human knowledge which can be wrong.² At the same time, we realize everyday and religious interpretative systems don't have to be naive, blind, or indeed opium, but can contribute to illuminating individual and collective horizons. Advancements in knowledge must also take place as a struggle for productive connections between everyday consciousness, religious interpretative systems, and scientific enlightenment.

What I have said regarding the Third-World countries is no less true of the industrial societies. The systematic destruction of agrarian cultures in these societies in the last thirty years could not have been done so thoroughly if it had not also been carried out as a struggle of a *seemingly* objective scientific and administrative rationality against a tradition which seemingly had nothing in its favour but the weak argument of this very traditionality.

Further impetus was given the geometrification of reality after World War I and during National Socialism and again after World War II. In less than 30 years, the Europeans had ruined (i. e., transformed to ruins) whole landscapes in many in-

stances, thus creating new wildernesses. After these wars, the smoothing over, straightening out, polishing, sealing off were renewed with doubled zeal.

The subsequent systematic urbanization and industrialization of rural areas destroyed the last remnants of wilderness, semi-wilderness, near-natural situations and non-geometric aesthetics in the process. The beginning of this last battle against everything non-linear, which is still going on today, can be quite precisely determined in Germany: it began with the great wave of mechanization at the end of the fifties, with the re-allocation of farmland, village-“beautification” campaigns, the dying out of small farms, etc. A particularly horrible role has been assumed in the last 25 years by European agricultural policy in Brussels.

At least in Germany, rustic cultures have also died out from lack of self-assurance and insufficient capability of self-organization. The farmers knew, or could have known, how much the smoothing over, straightening out, and clearing harms the landscape. But instead of taking a stand as proven experts on soil, plants, and landscaping, they followed the smooth models from the cities in their village-“beautification” campaigns and listened to the empty tempters, who talked them into heavy machinery, big fields, monocultures, Chemical Mace, and loans they could never pay back.

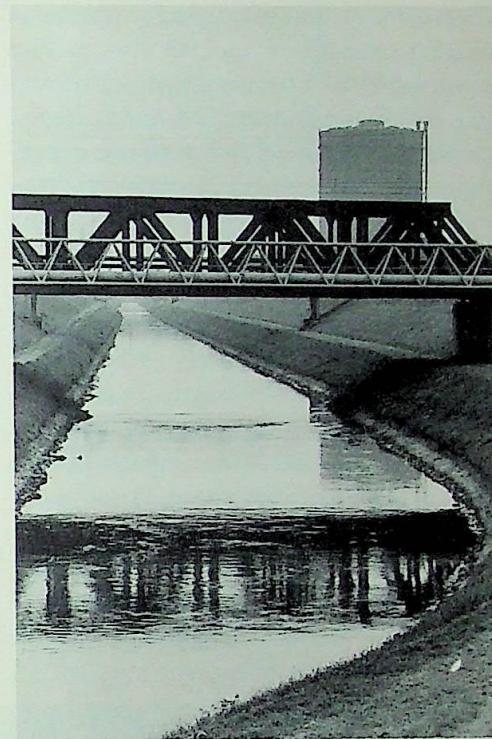
It is not very probable that a better-organized resistance of the farmers and the entire rural community, in the face of global social and economic trends and power structures of the past thirty years, could have really prevented the misguided and overcapitalization of agricultural production. But for our collective consciousness it is very significant that a struggle for other agricultural-develop-

ent models wasn't even attempted. A struggle of this kind could possibly have prevented the gravest extremes of land destruction. Above all, however, it could have become clear that the victorious strategy of false modernization and misguided capitalization is not without an alternative. This would facilitate a re-orientation to a truly modern, differentiated agriculture today, informed by classical experience and scientific research and precisely geared to the care of nature. The criticism directed towards rustic culture is just as true for many other landscape and nature planners, from urbanists to landscape "connoisseurs" down to private and amateur gardeners.

What is the substance of the consciousness stemming from this over-two-thousand-year-old process? What are the individual and collective functions of aesthetics of a certain kind?

There is certainly no mechanical transformation of economic necessities to perception and appreciation proclivities. At least one can speak of predominant trends and dispositions. Economic explanations are not enough. This is already evident from the fact that straightening, smoothing, and uniformization of our signs and landscapes have been consistently carried far beyond any economic benefit they may have had. Many steps were taken for the express purpose of beautification. Geometric urban and above all landscape planning couldn't have gained such unqualified acceptance if there hadn't been a deep-seated and pervasive willingness to accept it aesthetically – to find it beautiful.

When we deem something beautiful or ugly, it is always the expression of complex inner states and likings involving many factors having as such nothing to do with aesthetics. We found the omni-



Smoothing, straightening, clearing.
(Photo: Bilderdienst Süddeutscher Verlag/Manfred Vollmer)

presence of geometric aesthetics beautiful, and we still do: it is visually pleasant because it articulates and satisfies symbolically existential wishes and needs. It stands for progress, prosperity, neatness, healthfulness, order, feasibility, controllability, security. The symbolic representation of existential needs by geometric aesthetics doesn't pass through complex ideological filters, it is the direct expression of these feelings, hopes and needs. Of course the equation "smooth, straight, monochrome, monotonous, uniform = neat, orderly, modern" is based on mythologizing. This equation would not stand up to scientific scrutiny. But that does nothing to change the effectiveness of such elements of consciousness.

Aesthetic preferences can be so deeply

rooted in us that deviating phenomena can, for example, fill us with disgust. This close correlation between symbolism and physical and psychological needs allows the individual to feel that aesthetic experiences are elementary. His own feelings seem *natural* to him (in the sense of being innate, also morally normal, etc.). Deviating assessments are suspicious unnatural, even perverse. From this constellation of experience the self-awareness results with which conventional aesthetics is defended against competitors. A person pleading for letting gardens, parks, and landscapes grow wild is soon suspected of not washing regularly, either.

It seems as though the predominance of geometric aesthetics and its emotional implications is still largely intact as mass

consciousness and is even being intensified anew bit by bit. A definitive turning away from the smoothing, straightening, sealing off, and sterilizing of the environment has yet to occur. And at that, we also know what grave political risks are involved in the conglomeration of consciousness between certain psychological and social needs and aesthetics of a certain kind.

Order and Complexity

A monocultural, geometric aesthetics fosters benefit for totalitarian ruling systems by thoroughly resolving tensions between order and complexity in favour of order on the level of sensuous perception. The principle is the greatest order using the



(Photo: Bilderdienst Süddeutscher Verlag)

intensity, turning, brightening, environment, that, we risks are of con-hological of a cer-tural concepts.

core of totalitarian systems of government. In the process of consciousness formation, it provides crystallization points where boorish morals (infantile good/bad polarization) and black-and-white depictions in politics can effortlessly develop. In this way, fascism and Stalinism are *holistic*

As long as monocultural aesthetics strongly predominate in a society, it is a potential political danger for a democracy. The propensity of people to be misled by aesthetic impressions and the possibility of depriving them of their individuality making them toe a single aesthetic line of order, great challenges for any democratic nation. The aesthetics. It is the real vehicle of resistance against fascist/Stalinist aesthetics — more important than theories, slogans, attempts at verbal enlightenment. Educators, journalists, scientists, artists who succeed in familiarizing others with Picasso, Chagall, or the surrealists perform political work in the process. The probability that such people could succumb to the primitive pseudo-realisms of a fascist/Stalinist bent is far lower than in others who have not had access to this education and enlightenment. But all education has a difficult time if society as a whole is dominated by an aesthetic monoculture.

I should like to characterize democratic aesthetics as opposed to the totalitarian kind as follows: it is subtly distinctive, ambivalent, open, admits all ideas, rewards multiplicity and competition, leaves room for deviation, for experiments, discovery, comparison, assessment, evaluation, alteration. In this sense there are parallels between the cultural concept of democracy and the demands nature places on our sense of responsibility.

Aesthetics and Psychological Health

Aesthetics is often ambivalent in regard to its psychological effects. Smooth, straight, closed connote neat, orderly, secure in our culture. Thus, these combinations can be a source of psychological security and stabilization. On the other hand, visual uniformity of course entails a lessening of stimuli. In the aesthetic theories of the West it has never been disputed that beauty is constituted by multiplicity in unity, which means the greatest possible complexity in the greatest possible order. The tension between these two aspects is not eliminated in favour of one side, it is maintained and made productive.

The greatest possible order in the greatest possible complexity could appear to be the notorious quadrature of the circle. But that is not the case. We find this principle fulfilled a thousand times over in nature. Every intact wilderness, be it a jungle, savannah, fen, river landscape, ocean, or any other biotope, constitutes a realization of this interplay of the forces of order and complexity. On the basis of one fundamental type, complex orders come about, within which the relations between the individual elements (landscape, plants, animals) are not arbitrary, but ordered.

In the realm of human production, we experience this multiplicity in unity particularly in the arts, for instance in the great Gothic cathedrals, which display enormous complexity. Nonetheless, common traits and order can be found in all details. The same is true for painting, music, etc. One of the most impressive examples of the realization of the greatest possible order in the greatest possible complexity is jazz. Here, towering above a high plateau of structural order and freedom, is another aesthetic mountain, im-

provisation: on the basis of discipline, technical prowess, and command of the rules (order), the great freedom for developing an infinite diversity of harmonies and rhythms is unfolded.

But in our everyday lives, in urban planning, in landscaping, or production and the way free time is spent, this high standard can also be put into reality. In successful restoration projects of historic urban centres as well as in the construction of newly built districts and even in agriculture and landscaping, impressive examples of a complex, differentiated aesthetics have been achieved in the last ten to fifteen years. Unfortunately, they are far from comprehensive and numerous enough to bring about a reverse of the trend to geometric aesthetics.

The conversion of order *and* complex-

ity in our everyday lives is often not as completely successful as in the arts. But that shouldn't upset us. Of course we must make more compromises in everyday life than in art. This is not tragic as long as we keep the principle in mind and avoid the cardinal sin of breaking up the tension between order and complexity by taking sides with one of the two poles. When we dissolve the tension between order and complexity in favour of the latter, we feel overtaxed informationally. We experience chaos. When we dissolve it by destroying complexity in favour of order, a lack of information results.

This impoverishment triggers boredom and other psychological irritations. The paucity of stimuli in a monoculture offers too little challenge, narrows and suppresses our curiosity and perceptive pro-



(Photo: Bilderdienst Süddeutscher Verlag/Brigitte Hellguth)

ties, which are products of evolution and culture. The strong resiliency and adaptability of the human psyche does enable us to survive even in changed, markedly restricted environmental conditions. But such adaptation steps do not take place without psychological costs. Presumably, many psychological and social disturbances in modern industrial societies, such as diffuse lack of enthusiasm, frustration, loss of creativity, nervousness, depression, alcoholism, diffuse aggressivity in the family, at the workplace, and in traffic, as well as in other situations such as vandalism, are at least in part caused by a lack of natural visual stimuli, and the course of these disturbances offers no partial solution. According to my observations, children and young people suffer particularly from smoothed-over, desolate environments without always being aware of the reason for their lasting dissatisfaction, because the chance of comparison has long since been lost. They were born after the expulsion of hedges and bushes, in whose branches hide-outs could be built, and after the demise of the glowworm and the butterfly. Visual monoculture, despite or because of the straight line, constitutes a form of decadence, disorder, squalor which enters into a destructive intensification process with other factors (such as unemployment, etc.).

The upshot of all this is that the aesthetic dimension of shaping/destroying the world is not a marginal phenomenon which we can treat this or that way at will or choose to completely neglect. Visual and acoustic neglect of the world (there are comparable events in the acoustic sphere of geometric monoculture) is a central factor of the ecological crisis and is no less dangerous than the material pollution of soils, water, and air.

Geometric Aesthetics and Time

The spatial rationality of geometry is paralleled by one of time. With the aid of geometry, plans are devised, carried out, completed. Thus, in this century we have built entire cities *out of nowhere*, which were *finished* after their construction and have not significantly changed since then. The desolation of space goes hand in hand with a paralysis of time.

People become estranged to the experience of how things take shape and pass on, of making and creating things. Relations which are expressed in light and shadow scarcely permit differences between morning, noon, and evening to be perceived. Seasons have no contours. The passing of years can at best be discerned in the way buildings and streets get a bit drearier and greyer than they were when they were built. The number and diversity of natural time indicators is diminishing fast. The *situative differences*, which are so important for the individual and collective construction of experienced worlds, consciousness, and memory, are levelled off.

What Should Be Done?

We owe it to nature *in us*, to nature *around us*, our social relations, our psyche, and our political culture to take a stand against the totalitarian demands of material, biological, and aesthetic monocultures in all present-day societies, be they non-industrial, industrial, or post-industrial, and to develop differentiated and differentiating alternatives and put them into reality. But then, a new totalitarianism with reversed tendencies is not to be desired. In many realms of production and administration we will continue to find need for geometric aesthetics

which foster benefits there and develop a beauty of their own. The radicality of an approach to changing reality is not constituted by over-all acceptance or rejection, but by stringency and obstinacy in the concrete and particular, in the special case and detail.

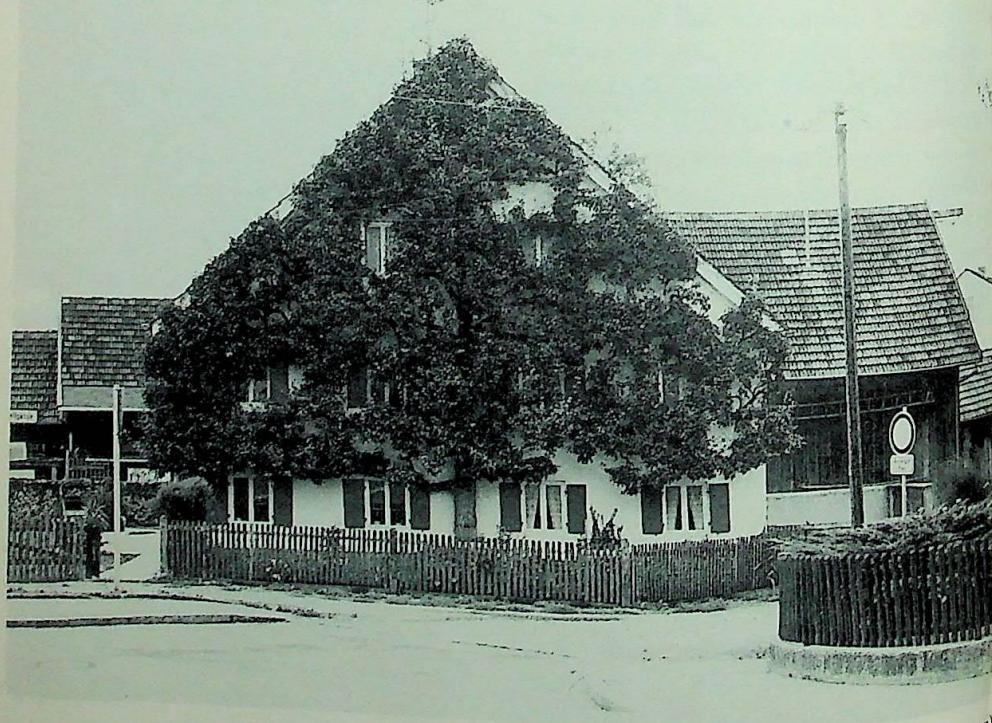
Reversing the Burden of Legitimation

However, we must grant no further bonuses to geometric aesthetics anywhere. In production and administration, in urban planning and in organizing transportation, but above all in the shaping and leaving alone of gardens, parks, woods, fields, and free landscapes, brooks, rivers, lakes, seacoasts, etc., geometric aesthetics may no longer be the unchallenged first choice. On the contra-

ry, it must compete with other, biological, aesthetic concepts and in the process be subject to a strict critical proviso: if there are no compelling arguments for conventional geometric configuration in a particular field, it should be rejected.

Irregular forest edges, overgrown or steeply dropping embankments (a salute to the kingfisher!) and edges of paths, meandering brooks, rivers, and paths, bushy gardens, hedges, swamps, forests; walls, towers, fences, and sides of houses overgrown with ivy, wild grapes, and polygonum; roofs with vegetation; and meadows with occasional fruit trees need no justification, but the straight line, the right angle, the cleared space, the sealed-over ground!

In discussions it is striking the way people who are in favour of an ecolog-



(Photo: Bilderdienst Süddeutscher Verlag/Gerhard Grausam)

ologically, process be if there conven- a partic- town or a salute of paths, d paths, forests; sides of grapes, vegetation; fruit trees ght line, ace, the we have to have a bit of order.'

It is high time to take on more self-confidence in this debate and to be more ecologically aggressive in our argumentation. We must insist that the straight line, right angle, and cleared space do not signify order in nature, but extreme forms of disorder, because they destroy complex orders.

Reversing the burden of legitimization must be carried out as a *democratic process*. More and more people must be won over by arguments and impressive examples of the new/old differentiated aesthetics. In doing so, active conservationists must seek the co-operation of potential multipliers in production, administration, educational systems, and the mass media even more single-mindedly. At the same time, however, the "real" transformation structures of opinion formation between the individual and society must not be neglected, i. e., the proximate social sphere consisting of family, neighbours, clubs, and – particularly important in democratic mass societies – the circle of friends and "cliques."

But apart from new information campaigns, changes in legislation must also be advocated. We must no longer allow

agrarian and other industries, landscape and urban planners, and people bearing political responsibility to clear out large tracts of land at will.

As to practical steps, I suggest starting with the simplest ones. Covering vertical surfaces with creeping plants costs almost nothing. Advertising and information campaigns by conservation groups have already met with some success in this regard. There are clearly more overgrown walls to be seen today than ten years ago. But much more would be possible and necessary.

To further spread this covering with plants, as with all the other steps, as well, objective information brochures are not enough. We must instead find ways of making people experience the stream of emotional warmth which emanates from biological, differentiated aesthetics and which is capable of fostering a feeling of *home* in their minds and hearts, which they will want to develop out of self-motivation.

Other steps, such as the cultivation and interconnection of hedges,³ the re-naturalization (and this means in a certain way re-cultivation) of rivers, brooks, fens, and woods, roofs with vegetation, etc. certainly involve more expense than creepers and also more strongly affect economic interests. Conflicts become more heated, and putting through solutions more proximate to nature becomes more difficult. Nonetheless, there are many possibilities to choose from here, too.

Finally, we must not fail to bear in mind that the aesthetic rehabilitation of the landscape is not possible without a much more profound transformation of industrial society, which we must now tackle much more consistently than hitherto.

¹ Exemplary glimpses of Europe's encounter with other cultures may be found in the novels of *Gary Jennings: Der Azteke*. Frankfurt/M. 1988; and *Marco Polo: Der Besessene*. Vol. 1 and 2. Frankfurt/M. 1987. — ² My thinking on science is strongly oriented to Karl Popper. His entire work is influenced by the realization of the risk of error in human knowledge.

Cf. Popper, K./Eccles, J.: Das Ich und sein Gehirn. München, 9th ed. 1990. p. 61 to 77. — ³ Extremely informative and practical is Benjes, H.: Die Vernetzung von Lebensräumen mit Feldhecken ['The Interconnection of Living Spheres with Hedges']. Munich, 3rd ed. 1991.

in Gehirn,
Extremely
Die Verner-
"The Inter-
Hedges"]

Ecological Sins, Dilemmas and Social Traps

Hans Lenk, Karlsruhe

The solution of today's dilemmas are treated controversially: While some offer rather individualistic propositions others suggest the complementing of institutional, structural or legal and political measures. It is obvious that a moral re-orientation of individuals is necessary, but not sufficient. Morality is more than a singular individual responsibility or obligation.

In 1988, courts in the Federal Republic of Germany heard 21,116 indictment cases in charge of damages to the environment. Although there were 16,557 suspects, potential damagers were sued in only 4,442 cases. But out of the overall cases only 1,344 (i. e. 11%) led to judgements of convictions. (In 1983 through 1985, there were only 97 convictions out of almost 28,000 ecological indictments. 48 of the convicted 97 individuals were not sent to jail but left free on probation!).¹

Ecological damages in the Western industrialized nations — if they can be assessed in monetary value at all — amount to about 3 to 5 % of the Gross National Product (GNP), this, however, does not include the (former) Eastern Bloc Countries. Yet, these damages are thus far not comprised in the GNP. Comprised, however, are the compensatory or defensive expenditures (amounting to about 10 % of some countries' budgets, e. g. of the

GNP of the Federal Republic of Germany in 1985), which are indeed an increasing factor for the GNP, although their sole function is damage compensation.²

Who is Responsible?

To begin with, ecological damages and, for that matter, irreversible ones can

Prof. Dr. Dr. h.c.mult.
Hans Lenk, professor
of philosophy at the
University of Karls-
ruhe, professor of
theory of science in the
social sciences and
planning theory at the
European Faculty of
Land Use and Develop-
ment, Strasbourg, Vice



President of the European Academy of Sciences and Philosophy of Law. Received his doctorate in 1961, in 1966 "habilitation" in philosophy and in 1969 in sociology. From 1973 to 1975 Dean of the Faculty of Humanities and Social Sciences at the University of Karlsruhe. In 1976 he was Distinguished Visiting Professor at the University of Massachusetts; 1987 Green Honors Professor at Texas Christian University. Since 1992 Honorary Professor at the Technical University of Budapest. President of the General Society of Philosophy in Germany.

Prof. Dr. h.c.mult. Dr. Hans Lenk, Kollegium am Schloss, Bau II, D-7500 Karlsruhe 1

usually not simply be attributed to a single (individual) producer or responsible person. For instance, at a 1989 hearing of the Economic Commission of the Lower House of the German Federal Republic (Bundestag) the external costs of environmental damages only concerning the field of motor traffic were assessed by the director of the Federal Agency for Environmental Protection (Umweltbundesamt), Lutz Wicker, at the level of approximately 50 milliards German Marks. But this also does not lead to individual damage attribution, to somebody who is or many who are personally responsible although car traffic is usually mainly considered an individual affair in the first place. (By the way, the total assessment of man-made damages to the ecology for the very same relatively small country amounted to 103,5 milliards German Marks.)

There is no such thing as solely economical, technological action on a purely individual basis, every techno-economical action is embedded in – and therefore implies – social and sociocultural contexts, is unavoidably a social action, and this applies to the same extent to the consequences of such actions. Usually every action has consequences for our environment, although not every consequence necessarily results from one single action itself.

The division of labor in corporations and large-scale projects on the one hand and the coordination of actions through markets on the other hand, but especially unwanted and yet unseen combinations of unfavourable factors, which are inclined to result in catastrophes, or even subliminal negligence or carelessness as with the so-called "normal catastrophes" analysed by Perrow will complicate the attribution of (unwanted) consequences of

actions, and the attribution of responsibility in all its kinds. The individualistic concepts of ethics and philosophy, technology and economy do not suffice to tackle these problems, they are obviously not adequate, since they usually focus almost exclusively on individual actions and not on interactional, collective and corporate forms of actions or structural and systemic contexts. Thus far ethical approaches have indeed been too much oriented toward individual persons, they have not paid enough attention to social aspects, they are not yet adequately adjusted to socioethics and sociophilosophy. This has been mentioned quite a while ago.³

It is true, so far the problems of complex constellations of causes and the problems of responsibility have been discussed only in a very generalized way in philosophical literature, while jurisprudence is considering them in a much more detailed manner and has indeed come up with some very interesting approaches for solutions – which are of interest for philosophy as well.

In addition, generally speaking one should distinguish the external responsibility for the organization and corporate action from the internal problem of responsibility distribution. The same is true with respect to institutional moral versus personal moral responsibility, although certainly an indirect connection obtains to be traced and analysed case by case which however does not amount to a general definitional reduction of corporate responsibility to solely individualistic terms or factors.

Corporations can act intentionally and non-reducibly (in a "secondary" sense, on a higher supra-individualistic, i. e. participatory, fictional, social level, which is symbolically and semantically structured

and interpreted; their actions nevertheless are "real" in their effects, for example in their social effects). Such a corporate responsibility, which is not equivalent with direct personal responsibility that only individuals have to bear, may apply not only to businesses but also to the state and corporations like associations of technicians and scientists or other professions. So far the traditional aprioristic thinking of attributing moral responsibility only to natural persons only with the concepts of responsibility defined but in individualistic terms seemed to set up insuperable barriers to the endeavour of attributing moral responsibility to corporations and institutions. Does this really and necessarily have to turn out like that? Have we failed in our efforts with respect to the development of exclusively individualistic models? Should we not rather develop a model with hierarchic levels that differentiates among the responsibilities on the various levels and does them justice?

Rendering or making corporations responsible may represent a first step towards attributing responsibility for corporate actions; the problem of distributing responsibility (in corporations) has to be approached then in a further step. The latter has to be treated with a differentiation among the various types of responsibility as mentioned. However, division of labor will complicate the perception and acceptance of responsibility as well as the attribution of respective consequences of a technology to an individual's marginal part within the totality. Thus, the abilities to perceive and differentiate responsibilities need to be improved as well.

We must differentiate between the problem of co-responsibility, i. e. the distribution of responsibility to (contributing) individuals in corporate or non-corporate action respectively, and the prob-

lem, whether or not corporations as such can be attributed a specific responsibility at all. The former topic consists of the question whether and how the various kinds of collective responsibility can be referred or reduced to individuals. (The moral responsibility of individuals should not — as we saw — be replaced or diluted by collective responsibility; individuals can be co-responsible.) This does not mean that collective responsibility is apt to be totally resolved or diluted into individual (moral) responsibilities in each case. Not every responsibility can be completely resolved into the respective individuals' singular responsibilities. Collective responsibilities may exist, that are not reducible to individual responsibilities „without remainder“, although they are at least connected with individual responsibilities and should be of relevance for these. The analysis of the intriguing connections is an important task of further pragmatic moral philosophy which indeed presupposes the elaboration of rather differentiated concepts of types and levels without which the interconnections could not be traced, identified and analyzed.

In economics and social science scholars speak of the externalities problem, side-effects, social costs, social traps, the Prisoners' Dilemma (PD), and the public goods problem. In the classical situation of the Prisoners' Dilemma two prisoners (A, B) are indicted for armed robbery. Both are offered to be chief witness and to come free without penalty. Both of them can only be convicted because of illegal possession of weapons. Therefore, if both remain silent, both have to expect only a rather minor punishment (of, say, one year in prison), but a much higher punishment (ten years), if one is convicted (punishment for the chief witness

would be zero). Therefore, confessing seems to be preferable as the dominant strategy. If one of the two confesses, it is also profitable for the other one to confess, because then he would receive eight instead of ten years imprisonment. The amount of punishment is therefore not only dependent on one's own strategy, but also on that of the co-prisoner. Now the dilemma of the social trap consists in the fact that it turns out to be irrational for A as well as B in their own interest to confess (dominant strategy). But if both of them would act rationally, i. e. both would confess, they would incur a higher punishment (eight years each in prison) than if both would keep silent (only one year each), i. e. if they would act cooperatively. Individual rationality therefore leads to collective irrationality and self-damage.

Is it Worthwhile to Be Cooperative?

We might easily conceive of a positive variant of the PD which we would like to call the Naturalists' Dilemma or, in more general terms, the Enjoyers' Dilemma or Environmentalist's (ED) with respect to scarce resources. Imagine the only lake in a nature-reserve which is to be enjoyed and partially utilized by anglers and waterskiers at the same time. For the sake of argument the lake should not be that large that both could enjoy their sport at or on the lake without interfering with one another. If both the anglers and the waterskiers would use the lake unrestrictedly they would not be able to enjoy their sport at or on the lake at all. The waterskier would mingle with the anglers' lines expelling and deterring the fish from the range of the anglers' reach. Thus, they apparently have to come to an agreement with one another in order to be able both

to enjoy a nature reserve. They have to arrange for restrictions by, e. g. segmenting space or time. They might allot part of the lake to the waterskiers and the other to the anglers or they might for instance allow to waterski only every second day. Other possibilities of restrictions are conceivable. However, any restriction and segmentation whatsoever would decrease a fullscale enjoyment of both parties. Therefore, the dilemma which arises does not develop from the bargaining of negative sanctions as in the classical PD, but it is a dilemma of the fullscale enjoyment with respect to scarce nature reserve. In this variant, not sanctions of the object of the potential agreement, but the possibility and degree of positively enjoying the natural source or resource are at stake. It is largely the same idea as Hardin (1968) had in mind with the overgrazing of the Sahel zone. The most important difference from the PD is that in ED situations tiered possibilities or levels of opportunities of utilisation do occur (by contradistinction to the yes-or-no-strategies involved in the PD model) which admit of variations with regard to degrees or intensity of utilisation or even partially dispensing with them. Here, the pay-offs may — within limits — be at will determined or chosen by steps.

It might be as difficult to reach an agreement in this sort of Enjoyers' Dilemma as in the classical PD. However, it is not just a change in signs in the respective utility and evaluation functions, but different points of equilibria might occur.

Generally speaking, the positive variant of the Enjoyers' Dilemma seems to be of considerable interest besides the classical and static PD restricted to a bargaining of negative sanctions. The Enjoyers' or Naturalists' Dilemma seems not only to apply to the use of common land or na-

re reserves, but also to privately owned and exploited land if it is embedded in an endangered ecological environment, because the groundwater level as well as clean air or drought or polluted air, erosion and depletion would not stop at a conventional borderline, but affect the whole local, regional or even continental ecology.

The central point with respect to the problem of the distribution of responsibility is the question concerning the normative and descriptive distributability in terms of the theory of action and the possibility of adequately reducing the collective responsibility to individual actors in relation to the form of collective actions and causations. Thus, the respective form of a collective action is of determining due and figures as a criterion for the distinction of various attributions of responsibility. Another important point is that the distribution of responsibility is dependent on the kind of responsibility: If one differentiates between a legal liability or compensation and moral responsibility, a distribution is (more) easily attainable with the first kind, while it might be (so) easy with moral responsibility. In particular, the negative formulations of a responsibility for prevention of damages and the preservation of states of well-being etc. are relevant for the distribution of responsibilities — as is the responsibility to prevent omissions, which is more easily accessible for a regulation of responsibility. One should also differentiate between the sufficient and the necessary conditions of a consequence or damage in relation to several involved persons' failures to act. So, the individual failure to act is causally sufficient for the occurrence of the consequence or damage, if non-omission of the act prevents this occurrence.

Thus, there exists an ethical obligation for humans to take care that especially humankind — as well as other natural kinds dependent on the human power for intervention — does not get extinguished. It is true that individual beings, which have not yet been conceived, have no individual moral or legal right to be born, and one cannot impose an individual obligation on particular human couples to procreate, but it seems to be a sensible extrapolation from the constitutional rights of humankind, which are else often only constructed as rights of repulse and protection, to develop a collective responsibility of today's living humans that they must not let their species be extinguished or destroyed. Humans have not only the — negative — responsibility to leave behind wholesome conditions of environment and life for future generations, which means they should not totally exploit non-regenerable raw-materials and should refrain from lethal poisoning, depletion and destruction of the environment. They collectively also have an obligation and responsibility to actively prevent this from happening and to work for a future existence of humankind in life conditions worthy of human beings. This is at least a moral demand which originates in the integrity and continued existence of humankind, which are considered the highest desirable values by various ethical systems. Even a version of Kant's (AA IV, p. 341) formal Categorical Imperative refers to the actual content of the "principle of humankind and of any reasoning nature" as things in themselves.

Judged morally, then, future generations' relative rights or quasi-rights to existence do exist, even though no singular existence of a non-conceived individual can be sued for on a moral or legal basis. Thus, certain general human and moral

obligations transcend those which are individualistically and juristically concretized. Moral value commitments are more comprehensive and determining than moral or legal individual responsibilities. Morality is more than a singular individual responsibility or obligation.

In the relevant publications the possibilities of a (complete) solution of the respective dilemmas are treated controversially: While some offer rather individualistic propositions others suggest the complementing of institutional, structural or legal and political measures. Not being able to comment on these more closely, I would like only to point out. A moral re-orientation of individuals is necessary, but not sufficient.⁴

In addition to a new orientation we need structural incentives, a defusing of situations which threaten to turn into a

dilemma, structural changes of the framework, social mechanisms for sanctioning and institutional legal and political measures. We need to examine a tiered system, a complete set of measures and put them into viable function if possible. This holds true in the same way for the problems in work-situations.

¹ VDI-Nachrichten, No. 23, June 8, 1990. —

² Stehling, F.: Ökonomische Aspekte des Umweltschutzes – Ökonomie und Ökologie im Konflikt? Discussion Paper (Nr. 360). Institut für Wirtschaftstheorie und Operations Research. Universität Karlsruhe 1989. — ³ Lenk, H.: Pragmatische Vernunft. Stuttgart 1979. S. 69. — ⁴ Ebenda.

Further Literature:

- Hardin, G.: The Tragedy of the Commons, p. 1243–1248, in: Science 162 (1968). — Hart, H. L. A.: Punishment and Responsibility. Oxford 1968. — Ladd, J.: The Ethics of Participation, p. 98–123, in: Nomos 16 (1975).

Prices Should Tell the Truth

Ernst Ulrich von Weizsäcker, Bonn

long as more prosperity inexorably leads to more destruction of the environment, environmentalists could get the impression that the market economy is the main enemy of the environment and that only the state can protect the environment from the market. This opinion is frequently met with and often combined with a plea for strict and detailed state intervention to protect the environment.

More Than Pollution Control

Human wealth and human welfare depend on a healthy environment. Today, the global environment is endangered. We must have to protect it. This has been a commonplace since the UN Conference on the Human Environment, held in Stockholm in 1972.

During the first twenty years of environmental policy, the name of the game was pollution control. However, pollution control remained very much the game of the North. For the South, development had higher priority. The Brundtland Commission came up with an elegant compromise: *sustainable development*. That, however, is quite a challenge, both for the South and the North. From the South, sustainable development requires strategies to reduce and eventually halt population increase, strategies to protect biodiversity, and the main-

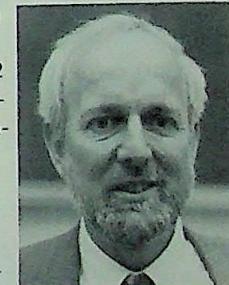
tenance, or development, of low input models of prosperity.

From the North, sustainable development requires massive debt relief (not just rescheduling) and the transfer of pollution control technologies. What is more, the North must arrive at a model of wealth which can be copied without destroying the ecological basis of life. I shall restrict my paper to the tasks of the North. Not only because I happen to live in the North, but also because what the

Professor Ernst Ulrich von Weizsäcker, born in 1939 in Zurich; 1972 to 1975 University Professor for Interdisciplinary Biology, Essen; 1975 to 1980 University President, Kassel; 1981 to 1984 Director of Science and Technology at the United

Nations, New York; since 1984 Director of the Institute for European Environmental Politics, Bonn, London, Paris, Brussels; 1987/1988 SEL-Foundation Professor, Technical University, Darmstadt. Main area of work: Environmental politics.

Prof. Dr. Ernst Ulrich von Weizsäcker,
Institut für Umweltpolitik,
Aloys-Schulte-Strasse 6, D-5300 Bonn 1



North does will most likely be copied by all.

The challenge to the North is formidable. Figure 1 may give an indication of the magnitude of the task. The Intergovernmental Panel on Climate Change demands halving CO₂ emissions within some forty years, while the forecasts at the World Energy Conference speak of a doubling of energy demand within that period. The biggest part of this demand will in all likelihood be met by fossil fuels. The nuclear option will remain a limited one because of still persisting major problems. Imagine purposeful abuse of fissionable material which will become available in ever larger quantities; and imagine the vulnerability of all nuclear installations to sabotage, war action and blackmailing.

It sounds at first completely illusory to arrive at a model of *wealth* (not of austerity) which lends itself to being copied by eight billion people.

However, here I am optimistic. Why?

First, because technologies and social innovations are available — or can evolve — which can gradually lead us into prosperity with virtually no destruction of depletable resources. The key word for the

new technological revolution is resource productivity. We should be able to quadruple energy productivity — which would solve the problem indicated in Fig. 1.

Second, because I feel that our present perception of environmental protection as *costs* is not necessarily correct. Using better policy instruments and correcting certain preoccupations, we can turn environmental protection into economic *benefits*. That should then make it easy for poorer countries to join in the environmental protection efforts.

Third, because enough pressure is building up from the South and from the young generation in the North forcing us to actually do what is theoretically possible. The UNCED process has greatly helped to create a global awareness and to increase the pressure in the necessary direction.

Once we have begun to believe in and to work on the *new vision of wealth*, we shall discover, I believe, that the more immediate tasks of debt relief and technology transfer become quite manageable. Also the pressing questions of waste, hazardous waste, acid rain, water pollution and site cleanup will become manageable once we are underway to an economy in which environmental protection is benefits rather than costs.

Costs or Benefits?

Pollution control involves costs without immediate benefits. This is because pollution control usually works at the end of the pipe, which means add-on costs. Countries or companies evading such costs will usually maintain competitive advantages over those applying pollution control technologies. "Pollution prevention pays" only where there is effective

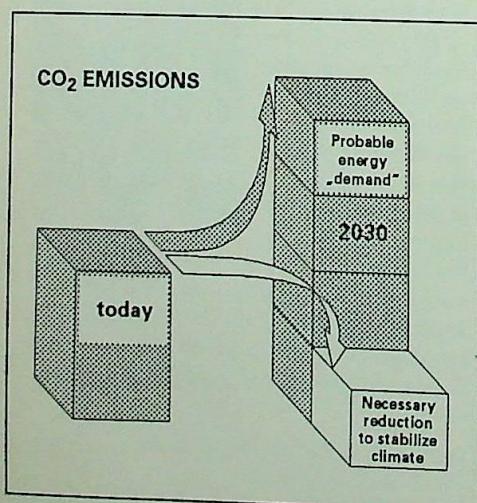


Fig. 1

resource
o quad-
which
ated in
Effective legislation punishing non-complying competitors. Hence the interest in international harmonisation on the side of countries with high standards.

Effective legislation means costs again, this time for administration, control, litigation and training. Small wonder that less affluent countries show little enthusiasm in adopting — and enforcing — high standards in pollution control.

On the economic level, the answer to this could be an environment round of GATT permitting rules for countries with a high level of environmental protection to introduce import tariffs against "ecological dumping". But this is not a very satisfactory road from the point of view of free trading.

Also, for the environment ecological protectionism does not lead very far. Most of the damage occur in countries which cannot afford, as they see it, the costs of any strict environmental policy. As long as costly pollution control retains the name of the game, I therefore see little hope for progress in environmental protection by poorer countries, which then leaves little hope for the global environment.

But how can we make environmental protection a win-win game (win for the environment, win for the economy)? Chiefly, I suggest, by switching emphasis from the end of the pipe to the ecologically important input factors such as energy, water, minerals, land. Consuming less energy while achieving — more or less — the same results should be good for the economy. Energy productivity can be increased by a factor three at least. Larger increases are conceivable, and switches to environmentally benign sources of energy — chiefly the decentralised use of renewables — give further relief.

Labour productivity in OECD coun-

tries may be twenty times higher today than it was 150 years ago. Technological progress was almost identical with the increase of labour productivity during these 150 years. Energy productivity, by contrast, increased only very slowly, as can be seen from the fact that energy consumption went almost in parallel with economic growth. As a tragic result, economists began to believe that energy consumption was actually an indicator of the wealth of a nation.

Today, labour shortage is hardly a problem, — at least not in the segment of the economy where more energy consumption is used to substitute human muscle labour. By contrast, energy consumption is a problem, and so are water shortage, the avalanche of wastes and biodiversity losses. Any efficiency increases in the use of energy, water, minerals or biomass could mean less mining, less transport, less waste and less habitat destruction. Increasing energy productivity and other resource productivities should be a very important element of the wealth of nations today. As a comparison among different nations shows, high energy productivity is a better indicator of than energy consumption for the macroeconomic performance.

But what is true on the macroeconomic level is not automatically true on the microeconomic level. In fact, resource efficiency is absolutely secondary for most players in our economies. Why this? The answer is simple. Energy, water, minerals, etc. are underpriced. We don't pay any price for resource depletion, the greenhouse effect, landscape destruction or biodiversity losses. And we pay an insufficient price for pollution and waste disposal. Prices tell us at the microeconomic level that wasting the treasures of nature is reasonable.

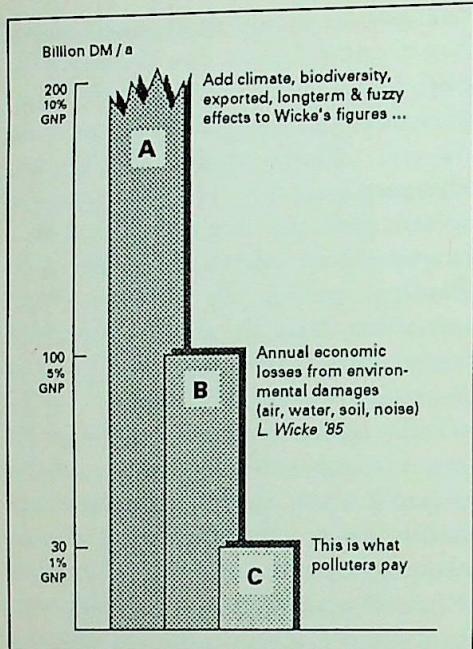


Fig. 2

Prices don't tell the truth — which, according to the economic theory built on Adam Smith's work, is bad for our wealth.

But what is the truth? The truth will never be established in sound scientific terms. But there are reasonable estimates available. Lutz Wicke, then head of eco-

nomics at the German Federal Environment Bureau, estimated annual economic damages resulting from environmental pollution to some 100 billion DM for West Germany in 1985, which was roughly 6 % of the GNP. He restricted himself to the classical factors such as air, water and soil pollution and noise. If resource depletion, greenhouse effect, exported damages and long-term damages were added, an estimate of 200 billion DM or more would arguably be a realistic figure. This contrasts with some 30 billion DM polluters are paying annually (see Fig. 2). More than half of the damages are related to energy production and consumption.

The task of making prices tell the truth could then be described as putting an additional price of some 5 to 10 % of the GNP on the use of energy and other resources. And according to theory, that would make countries richer, not poorer. There are, in fact, some surprising empirical indications that this may be true. Comparing the economic performance over the last 15 years of the biggest industrial powers shows a clear hierarchy; and looking at the average domestic energy prices which these countries maintained you see a positive, not a negative correlation (Fig. 3). The worst economic performance was achieved by countries which subsidised energy and water use, namely the socialist countries.

Although the collapse of the socialist system has brought world market prices into Eastern European economics, the end of the tragedy is not yet in sight. In their desperate attempts to survive the next years, the Eastern market economies seem to be forced to specialise on selling energy, minerals, wood and bulk chemicals, thus maintaining the bulky and old-fashioned bias of their production.

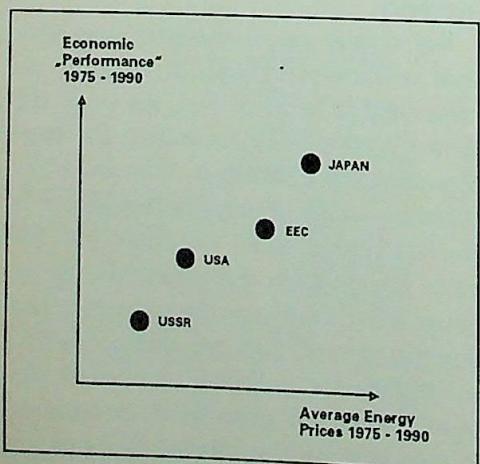


Fig. 3

Very high energy consumption is becoming a symbol of backwardness. Efficiency orientation in the use of energy and natural resources in my view will be the clue to making environmental protection a win-win game. And pricing is the market economy tool for this efficiency orientation.

Ecological Tax Reform

Pricing can be done either directly via taxes or charges, or indirectly via regulatory constraints or tradeable permits. Regulation or permits tend to involve high administrative and monitoring costs and are therefore unlikely to work effectively in less developed countries. For practicality and welfare reasons I would favour direct pricing of ecologically important input factors. Controlling and taxing crude oil, crude chlorine or mercury is much easier than monitoring effluents or controlling the correctness and legitimacy of a permit at each transaction.

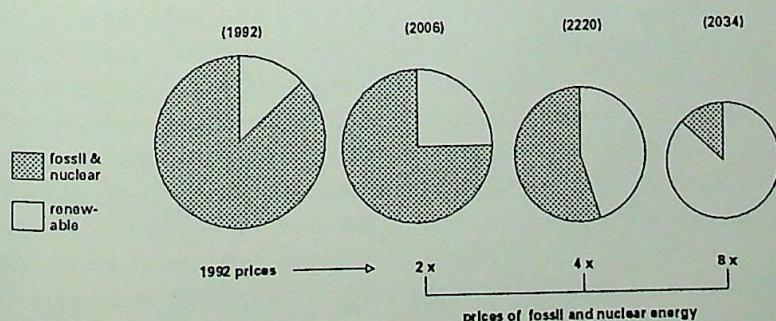
Among the pricing instruments, environment ministers tend to favour special charges over taxes. Charges mean that the revenues are earmarked for good works to be done by the environment minister.

But quantitatively, the instrument is very limited. Earmarked charges mean additional financial burdens on the economy. The German Environment Minister Töpfer came under heavy attack from business for his proposals of additional charges on waste and CO₂. Moreover, charges require a fairly solid proof of who was the polluter and which remedial measure is justified. This burden of proof involves substantial monitoring and control costs (no less than command and control instruments).

I am not surprised that the total amount of charges collected in OECD countries remains smaller than 0,1 percent of the GDP of these countries.

Taxes, by contrast, are not earmarked. Therefore the state is free to use them for no other purpose than to reduce other taxes, notably VAT, income taxes or corporate taxes. The overall fiscal burden would in this case remain constant even if fairly substantial "green taxes," e. g. of an order of magnitude of 5 % of the GDP (fifty times the size of present charges), are collected.

Revenue-neutral energy taxes of this size are likely to have a steering effect far exceeding that of present charges. Assuming that chiefly fossil and nuclear energy



would be taxed, the share of renewables would increase while the size of the energy pie would shrink. If the price of fossil and nuclear energy was doubled, the total pie would shrink by some 20 % (allowing some fifteen years time of adjustment). The portion of renewables could easily double. More drastic effects should be expected from a quadrupling or octupling of fossil and nuclear energy, as Fig. 4 indicates. Some substitution effects from fossil and nuclear to renewables are actually just around the corner.

If energy taxes and other green taxes are introduced in a revenue-neutral manner — as I suggest —, one would speak of an ecological *tax reform*, rather than of taxes. The tax reform would substantially depenalise and hence encourage human labour, the creation of added value, and corporate activities, while wasteful technologies, wasteful consumption patterns and wasteful infrastructures would be gradually driven out of the market.

To avoid negative distribution effects, some compensation should be offered: in the European context it might be sufficient to lower the VAT, which has very similar distributive effects green taxes. But additional compensation may have to be considered.

To avoid ruptures both on the side of producers and of consumers, the ecological tax reform should proceed rather slowly but steadily. The slowness of change is necessary to give technology development, infrastructural changes, training and cultural changes sufficient time. The time horizon of such changes is twenty to fifty years, not two to five years!

Some people doubt that there is any price elasticity in the consumption of basic commodities. However they normally think of short-term elasticity only. Long-term elasticities could be observed when we look at different countries which maintained different price levels

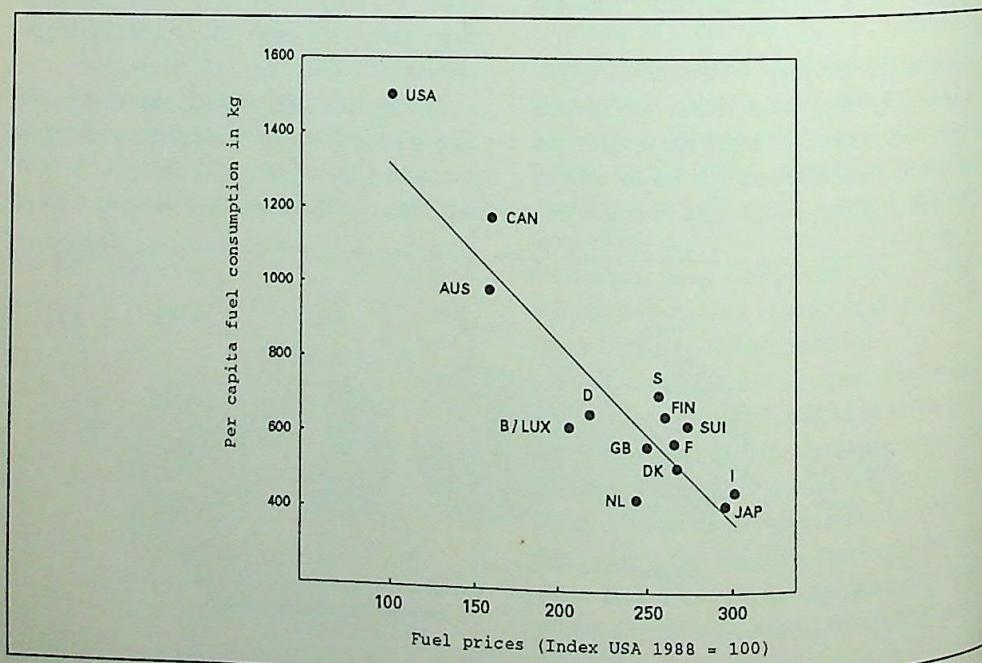


Fig. 5

er a reasonably long period. Fig. 5 shows the per capita petrol consumption of different OECD countries plotted against the petrol price. The negative correlation is striking.

For practical politics I am suggesting a revenue-neutral tax reform which could increase prices by five percent annually — in constant dollars — for fossil and nuclear energy, for water and for bulk minerals. In the energy field the first steps in many countries could be done by just cutting existing tax privileges and subsidies. For problematic substances such as mercury, chlorine, nitrates, sulfur (e. g., in fossil fuels), the price increase could be steeper, with no harm to the economy; and the tax should apply only to virgin matter — so as to encourage recycling.

The Benefits Are Real

Let us have a look at the effects such a change may have on different budgets. Energy costs in German industry (which are higher than in most other countries) are estimated to represent some 3,5 % of the total costs. If energy prices rose by 5 % that would mean cost increases of $3,5\% \times 5\% = 0,175\%$. For private households the figure would be about 0,25 %. We can further assume that macroeconomic, i. e., systemic energy productivity gains are achieved of some 3 % per year. This is a very modest estimate considering the existing technical potential of 100 % – 300 % productivity gains, depending on the special case and on the definition of substitutability. If therefore energy consumption may decrease by 3 % per year without sacrifice in energy services, the annual energy cost differential would be reduced to 5 % minus 3 % = 2 %, and the total cost differential for industry would fall to an insignificant 0,07 % per

year. And if simultaneous tax reductions worth some 0,2 % of total costs are added, we see that the whole operation results in economic benefits for industry as a whole. For energy intensive sectors some transitory arrangements may be found to at least secure full depreciation of existing installations.

For countries like Bangla Desh, Egypt or Nicaragua, an increase in energy productivity should be economically even more beneficial than for Germany or Japan. For Mauretania or Iran, a drastically increased water productivity (which would result from a rational water pricing policy) would be infinitely more important than for Britain or Canada.

The benefits are real also for a different reason. Energy productivity gains help to avoid environmental costs; and they help to avoid construction costs for power plants and other costs involved in energy production.

Obviously, I am not advocating an abandonment or even a stand-still of command and control policies. For fighting dioxin or CFC emissions, a chlorine tax is not enough. Certain highly toxic substances have to be banned altogether. Accident prevention and landscape planning require other legal measures than just prices.

However, some classical waste and pollution problems are likely to just disappear once the ecological tax reform has worked for a certain period of time. Much of the present "waste" would be turned into valuable materials once energy and raw material prices have gone up sufficiently. Dioxin loads would be substantially reduced when chlorine ceases to be cheaply available. Eutrophication of surface waters would recede as the influx of nutrients (e. g., from overseas) is reduced as a result of rising energy prices.

Hence I would not be surprised if a new generation of environmental legislators after some ten or twenty years of an ecological tax reform will begin to "clean up" the thicket of regulations that is now annoying the corporate world without actually preventing further ecological destruction. In particular, many of the sudden and unpredicted regulations could disappear which had their origin in the response to a local scandal and which subsequently caused much headache to company managers.

By contrast, the predictable pace of a long-term and slow ecological tax reform — that sounds too good for the business

world to be true. Even if some will be on the losing side. But under the conditions of ecological collapse or of sudden political panic there would be infinitely more losers.

Further reading:

- Cairncross, F.: Costing the Earth. The Economist Books, London 1991.* — *Pearce, D./Markandya, A./Barbier, E. B.: Blueprint for a Green Economy. Earthscan, London 1989;* — *Pearce, D. et al.: Blueprint 2, Greening the World Economy. London 1991.* — *von Weizsäcker, E. U./Jesinghaus, J.: Ecological Tax Reform — Policy Proposal for Sustainable Development. Zed Books, London, May, 1992* — *von Weizsäcker, E. U.: Earth Politics. Zed Books, London, 1993.*

SPECTRUM

smology

Correcting Einstein's Error

Einstein thought his "cosmological constant lambda" was the "greatest folly" of his life and regarded it as negligible in the calculation of his model of creation. Bonn scientists did not heed his recommendation and used it in calculating the origin of the cosmos and arrived at a new model of creation. This "Bonn Model" could leave a lasting mark on future cosmology.

What did God do before he created the material world?" is something St. Augustine ready wanted to know in the fourth century and, as a warning to the all-too curious, he had a seemingly witty answer ready: "He created Hell for people who ask questions like that."

Neither the learned man of the church nor the scientists of the modern era could be prevented from looking into the origin and development of the cosmos. Particularly in this century, cosmology succeeded in taking the crucial step from the more nebulous realm of speculation to the level of verifiability by experiment. The first person to tackle the question of the origin of the world we know it was none other than Albert Einstein. In 1917, he fashioned from the equations of General Theory of Relativity, which was based on the

equivalence of heavy and inert mass, a first scientifically verifiable model of creation, which he claimed describes a universe which remains the same for all time, whose stars and galaxies were equally distributed over a closed, but limitless space. Since then, all standard cosmological models were based on Einstein's world-famous field equations, which are undisputed because they have consistently been corroborated in numerous experiments, but they were never applied in their totality.

In the "Bonn Model," a team of cosmologists have not only corrected a fallacious assumption of Einstein's in this regard. More than that, Professor Wolfgang Priester of the Institute for Astrophysics at the University of Cologne, together with Dr. Hans-Joachim Blome of the German Research Institute for Air and Space Travel (DLR) in

the Porz section of Cologne, and Diplom Physicist Josef Hoell of the German Space-Flight Agency (DARA) have developed a model of the universe which could leave a lasting mark on cosmology in the future.

The Universe Is Older than We Thought

First of all, on the as yet unsolved question of the origin of the stellar systems and the time needed for them to form, a rather surprising answer was given: according to it, the universe is about double its hitherto assumed age of 13 to 20 thousand million years. The matter of the cosmos has existed for more than 30 thousand million years (with a period of error of plus or minus four thousand million years). This amount of time is required, in the opinion of the three cosmologists, for the galaxies — those large stellar systems, one of which is our Milky Way — to become the way we see them today. All of them go back to the Big Bang, which was the beginning of the origin of matter and caused the cosmos to expand extremely rapidly. But this velocity was also what must have prevented a condensation of matter in the

form of clouds of gas in huge spirals — galaxies — from occurring right away.

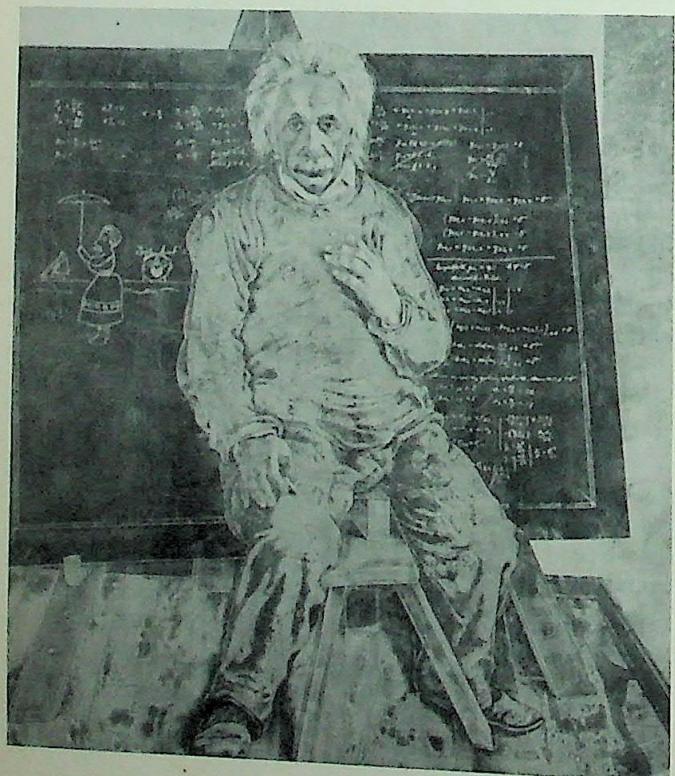
According to Priester's interpretation, the galaxies couldn't have formed in the hitherto assumed time if the cosmos had gone on expanding so rapidly after its explosive initial phase. The "Bonn Model," which is based on computer calculations, therefore provides for a kind of rest period, a hesitation of the cosmos. This gave matter time to condense into stellar systems before expansion set in anew with greater force, the astrophysicist says and adds: "According to our model, the universe will go on expanding throughout the future, as well." Whereas physicists had hitherto exclusively followed Einstein's recommendation and used the abbreviated form of

his equations in their calculations, the Bonn scientists experimented with the additional cosmological constant lambda they had rediscovered several years ago. Because of its obviously extremely low numerical value, it had always been equated to zero, because Einstein himself was of the opinion that his cosmological constant could be done without. In 1930 he even suspected that the introduction of lambda was perhaps "the biggest folly" of his life. At that time there was, to be sure, no way of measuring lambda precisely, "but simply equating it to zero turned physics upside down," Priester says. He thinks this number is crucial "for the structure of the cosmos and its final rate of expansion," regarded neglecting the constant as unjustified, and consid-

ered it necessary to arrive at a new numerical evaluation of it. This is particularly true for the problem of the origin of the galaxies. For the formulae which are jokingly referred to as "catered field equations" result in models with such low ages of the universe that there is not enough time for the clouds of gas to condense into galaxies. In this way, hypotheses cropped up in standard cosmology concerning "dark matter." According to them, in addition to visible matter in the form of gases and stars, about 90 percent of the cosmos consists of invisible "exotic" particles. With the aid of this much denser matter, it would be conceivable that even ten or twenty thousand million years would have sufficed for the origin of the galaxies — if it hadn't later been discovered that the universe is interspersed with spacious bubble structures surrounding empty spaces, on whose wall-like boundary surfaces the stellar systems are arranged. Dark matter does not sufficiently explain how they were formed, either.

"Lambda" Plays a Crucial Role

The Bonn scientists prefer to bank on the "energetic potency of lambda", which they rediscovered and which, their findings show, describes the crucial influence on the chronological course of expansion velocity and determines the rate of expansion, which is known in the field as the "Hubble number." It is named after the American astronomer Edwin Powell Hubble, who discovered in 1929 that stellar systems



4/1992 UNIVERSITAS

oved through the universe in a astounding manner: the fur-
ther away from the earth a gal-
axy was, the faster it moved
away from it.

The Hubble number is the pro-
portionality factor between the
velocity with which an object is
moving away from an observer
in the universe and its moment-
ary distance from him. This ve-
locity is expressed in kilome-
ters per second per distance
unit, where one such unit
equals 3.3 million light years or
1 trillion kilometers. How-
ever, the exact value of this
number is the subject of scientific
controversy amongst as-
tronomers throughout the
world. If it is assumed that the
origin of galaxies could not be
explained with Einstein's lamb-
constant, the measurement
of the Hubble number would
be crucial, Priester explains.

The Origin of Galaxies Discovered by Accident

at the key to the origin of gal-
axies was found by Wolfgang
Priester, as he says, purely by
accident, while he was studying
the spectrum of a newly discov-
ered quasar which he happened
to be preparing for a scholarly
lecture. Light from the most
distant quasars has been on its
way for over 20 thousand mil-
lion years before their spectra
can be analysed in the observa-
tories, the astrophysicist ex-
plains. The quasars' spectra not
only betray the chemical com-
position of the hot, dense gases
surrounding the quasars, but
beyond that they provide hints
on the number and spatial ar-
rangement of the hydrogen
clouds and galaxies along the
path the light takes to the earth.

Using the spectra of remotely
distant quasars, the structure of
the cosmos can be fathomed.
This makes them into a sensi-
tive test for cosmological mod-
els. The light radiated by a
quasar moves through space at
a constant velocity of about
300,000 kilometers per second,
only its wavelength changes. If
it comes to earth from a quasar
which is "speeding off" in space,
the waves oscillate that much
more slowly: light that was, for
example, emitted in the ultra-
violet range is now registered as
a "colour line" in the red or in-
frared range. This effect, which
is generally referred to as the
"red shift," is a yardstick for
measuring the distance of an
object in space.

Now, when the light of a quasar
passes through a hydrogen
cloud, the Lyman-Alpha Line
from its spectrum is absorbed.
Due to the fact that the hydro-
gen clouds and galaxies are dif-
fering distances apart, such ab-
sorption lines occur corre-
sponding to the red shifts and
are distributed over the entire
spectrum. For some quasars
over 100 of these lines have
been counted. The Bonn sci-
entists, in co-operation with Pro-
fessor Dierk-Ekkehard Lieb-
scher of the Astrophysical Insti-
tute in Potsdam, have thus far
analysed 20 quasars with a total
of 1260 such lines. Each of them
displays typical patterns and in-
tervals, thus providing informa-
tion on the distribution of gal-
axies and clouds located along
the path of the visible radiation.
In order to subject their model
to a critical test, the cosmolo-
gists are interested in finding
out how many clusters of galax-
ies and matter-deficient void

spaces the quasars' light has
passed through on its way to
the Milky Way. They also ana-
lysed the absorption lines as to
whether they provided any
clues on the origin of the
bubble structures and how they
are distributed in the remotest
regions of the universe. A spa-
cious, equally distributed bub-
ble structure was the result if
30 thousand million years were
assumed to be the age of the
universe, which testifies to the
correctness of the "Bonn
Model," which states that the
cosmos exists in a closed space.
Its present radius of curvature
is 36 thousand million light
years. It is steadily increasing –
in the remote future it will
reach infinity. The particular
feature of this model is a long
phase of very slow expansion
lasting five to ten thousand
million years after the origin of
matter. In this time, galaxies
can form, and without exotic
dark matter, at that.

Cancer Research

Why Are Tumours Malignant?

(df). How does cancer spread
through the body? A crucial
prerequisite for the forma-
tion of metastases has now
been found. The spreading
cancer cells bear "adhesive
proteins" on their surface,
which are also typical for
completely normal immune
cells.

Cancer is an insidious illness.
Even if a malignant tumour has
been completely removed by
means of an operation or radia-
tion, metastases can occur in
completely different places –

often years later — and destroy vital organs. In order to prevent the lethal wandering of the cancer cells which trigger this process, it first has to be found how they cause this to happen in the first place.

How cancer cells spread over
For vagabond cancer cells jump over hurdles which are insurpassable for most other cells: first, the cell separates itself from its neighbours in the tissue complex of the tumour and enters the blood stream or lymphatic circulation. Here it succeeds in escaping the attacks of the "health police," the white corpuscles, and to leave the blood vessels undamaged. Finally, it smuggles itself into another tissue complex, ensconces itself there, and quickly begins to divide.

The molecular ticket

The ticket for this journey through the body is only carried by the metastasis-forming cancer cells on their surface — there are no free riders. This crucial "sticker" was discovered by scientists at the German Cancer-Research Centre (DKFZ) in Heidelberg and the Nuclear Research Centre in Karlsruhe (KfK). On the cell surfaces of tumours of the pancreas in rats, the Heidelberg scientists under Dr. Margot Zöller found a protein which only occurs in metastasis-forming cells; in tumour variations which cannot form metastases, this surface protein is missing. Surprisingly, Professor Peter Herrlich and his co-workers found in analysing its structure that this "metastasis protein" is no stranger: the protein resembles the CD-44 molecules in

the cell membranes of white corpuscles, which indeed have properties similar to the wandering cancer cells. They, too, travel through the body via the blood stream and lymphatic circulation and can leave them and penetrate into other tissue and organs. And CD-44 apparently helps them to do so: with the "adhesion molecule" the leucocytes stick to the epithelium cells lining the blood stream and lymphatic circulation. Their precise function is still unknown, however.

The blueprints of the two proteins are in the same segment of the genetic material. In both cell types only differing sections of the common gene are read. This is why both proteins are almost completely identical in structure and sequence of amino acids, and their function may possibly be the same, too. Due to this relationship the Heidelberg and Karlsruhe scientists call their discovery V-CD-44 — variant CD-44.

After localizing V-CD-44 in the genetic material, the scientists in the German Cancer-Research Centre performed an elegant experiment to test its role in metastasis formation. They injected the gene into tumour cells of the rat which had hitherto been unable to form metastases. And sure enough, the cancer cells reacted to the genetic manipulation: they separated, wandered to other parts of the body, and produced metastases there. The opposite effect was obtained by the scientists by treatment with an antibody to V-CD-44, which attaches itself to it. Tumour cells blocked in this way were unable to form metastases.

Occurrence of other "adhesive proteins"

In further studies, the "adhesive protein" was not only discovered in malignant tumours of the colon, but also in completely normal cells of the skin, the immune system, and the intestinal mucous membranes. These healthy cells share some properties with the wandering tumour cells, since they can also actively divide and change their location. But in contrast to them, for example, the V-CD-44 only travel an exactly determined distance and then terminate their self-division activity and also the expression of V-CD-44. Wherever the molecular ticket has hitherto been found on healthy cells, its presence on the cell's surface was always precisely controlled and limited to a definite segment of development. Only in the metastasizing tumour cells does this rule seem to be out of control.

The new findings could also open up new paths in the fight against cancer; but for the moment they provide important insights into the complex mechanisms of metastasizing, for a new strategy in fighting cancer cannot yet be formulated. With antibodies which attach themselves to the V-CD-44 protein on the surface of the cancer cells and thus block it, the formation of metastases could indeed be prevented. But this method can only be employed prophylactically, as only cancer cells which are on the move in the body can be checked in this way. Metastases which are already proliferating can no longer be stopped.

economy

Development Aid for the Sahel Zone

adhesive
y discov-
hours of
complete-
skin, the
ne intesti-
es. These
me prop-
er tu-
can also
nge their
contrast to
the V-CD-
tly deter-
en termi-
n activity
ission of
he molec-
rto been
its pres-
face was
ollled and
gment of
the me-
ells does
ut of con-

uld also
the fight
the mo-
important
complex
stasizing,
fighting
formulat-
which at-
the V-CD-
ce of the
block it,
metastases
nted. But
be em-
ally, as
h are on
y can be
metastases
lerating
ped.

uw). Not only in civil-war-torn Somalia are hunger and mis-
trampant, in all of Africa more and more people have access
less and less food. All efforts of development policies seem
run dry in the desert of bureaucracy; industrial or agrotech-
nological projects fail at the outset or at the latest when the
rst replacement parts for tractors are unavailable. But instead
Western know-how, the farmers in these countries need
actical help enabling them to develop on their own.

grarian research is concerned about 80 percent with problems affecting at most 20 percent of the global population. At it is primarily the non-industrialized countries of the southern Hemisphere, whose population lives directly from agriculture, that urgently need improved production methods. The import of western technology, seeds, or advice usually ends up on a dead-end street, however, as it seldom takes the conditions of the steppes or arid lands nor the requirements of farmers into account. New methods must be based on traditional ways of farming, improving them step by step. But in order for the implements, plant varieties, or cultivation methods to really facilitate the farmers' lives, it is necessary that all the given external influences, from climatic conditions to market prices, are given due consideration whenever possible.

For the first time, an attempt is now in progress in West Africa to obtain precise knowledge of the complex conditions of small-scale agriculture, so as to be able to improve it later with lasting effect. In arid Niger and Benin, which has relatively high precipitation, some 90 scientists from widely differing

fields have been working together since 1985. The soil scientists, chemists, and psychologists have set themselves an ambitious goal: they intend to "work out an exemplary integrated plan for developing site-adapted efficient forms of small-scale farming systems," which also spare the environment and resources. The mammoth project is directed by the Tropics Centre of the University of Hohenheim.

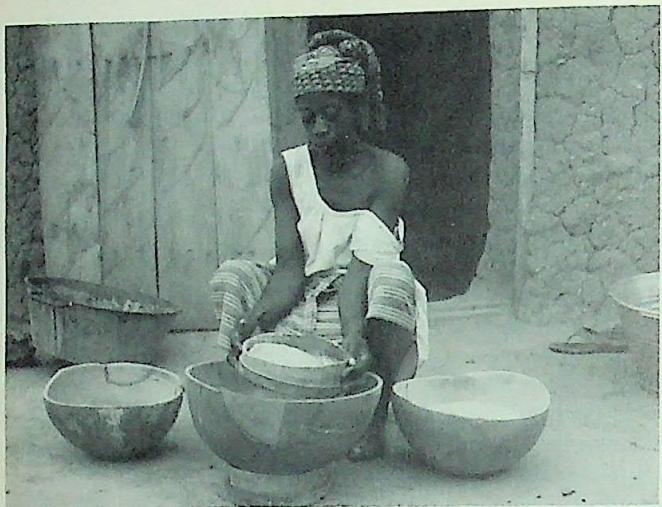
The farmers in Niger, which has little precipitation, primarily plant millet and peanuts, and

the intensive cultivation without corresponding fertilization increasingly depletes the soil. A promising way of increasing the nutrient and mineral contents of the fields is the working in of crop residues; studies have shown that above all phosphate requirements could be met by mulching under millet straw. And the Hohenheim scientists put other plants in a wind tunnel. It is planned to have the resistant species protect the African fields from erosion at a later date.

The farmers in Benin have other problems to worry about. In the humid climate of this region between the Niger and Volta Rivers, weeds also thrive very well. To combat them with as little environmental effects as possible, plant ecologists suggest alley cropping. This method involves planting rapidly growing tropical tree and shrub species between the food plants. In the shade of these ad-



Test field fertilization techniques with mulched millet stalks.
From: Leisinger, K. M.; Schmidt, H. (eds.), "Überleben im Sahel" ("Surviving in the Sahel"), Birkhäuser, Basle, 1992.



Sifting millet

From: Leisinger, K. M.; Schmidt, H. (eds.), "Überleben im Sahel" ("Surviving in the Sahel"), Birkhäuser, Basle, 1992.

ditional plants, the weeds cannot grow, as they need lots of light. As a side effect, the green sunscreens enrich the soil with organic matter and nitrogen. Another natural instrument for increasing harvest yields is "managed fallow": in a field cultural plants such as maize or manioc are cultivated alternatively with fallow plants such as nitrogen-enriching clovers. As in southern Benin two rainy seasons ensure two harvests per year, "rest periods" such as this are an obvious alternative there.

All cultivation systems and plant species are tested in experimental fields before they are used on the farms. During the entire vegetation period, laboratory workers determine the nutrient and mineral contents of the soil samples, their humus supply, and water content. Soil temperature, seepage, and water tension are further parameters providing information on the complex effects of the cultivation methods. For

the goal is not increasing the next harvest, but also lasting improvement of the water balance, soil climate, and nutrient supply.

But the scientists are not only interested in soil samples and photosynthesis rates, they also study the price policies, which are often state-controlled in West Africa, and their interactions with agriculture. It is important, for example, to know which products can expect stable prices.

The attention of the agro-technologists of the project is concentrated on zebu cattle. They study the energy transformation and working efficiency of the animals and in the process have developed an improved form of the conventional neck yoke for draught animals; by padding the harness their work performance can be markedly increased. Building the new implements — a simple weeding hoe drawn by donkeys and a "trailer" for the single-axle carts in use in the Sahel Zone are also

planned — is done in co-operation with local village blacksmiths. For one thing, the implements could in this way be made and repaired in the village later, too, and furthermore, the people are then already familiar with the innovation. Indeed, acceptance by the populace is the often neglected hurdle over which many well-meaning aid measures have stumbled. Whether modern techniques are accepted by the farmers often strongly depends on the socio-cultural given conditions of a country. The structure of family and village are as much a factor as climate and field size. In the Sahel Zone, the innovation process is making particularly slow progress. For the unpredictable adversities of nature have taught people to take on a cautious, conservative attitude. As a social securing of the elderly or the ill is completely lacking, people cannot afford to take any more risks. Socio-ecological and psychological studies are thus just as important for development policy as cultivation methods tried and proven in the laboratory and the experimental farm. The research project "Site-adapted Agriculture in West Africa," which is a comprehensive whole, arouses hopes for truly meaningful development aid. With a truly interdisciplinary project, scientists from the University of Hohenheim hope to be able to make an effective contribution to the development of the countries of West Africa, to whom merely short-term "help for self-help" is no help at all. Donkey carts instead of tractors for the Sahel Zone.

story

The Limes Was Not a Line of Defence Against the Teutons

The Roman limes is celebrating a birthday: one hundred years ago, archaeologists, historians, and members of the military convened to found the Reich Limes Commission to study the most magnificent archaeological monument in Central Europe. The limes runs for over 500 km across Southwest Germany and is even visible today in fields and woods in many places. By now it is known that the Roman monstrosity built poles and walls was not a line of defence against the Teutons, but simply a line of demarcation between the Roman Empire and free ancient Germany.

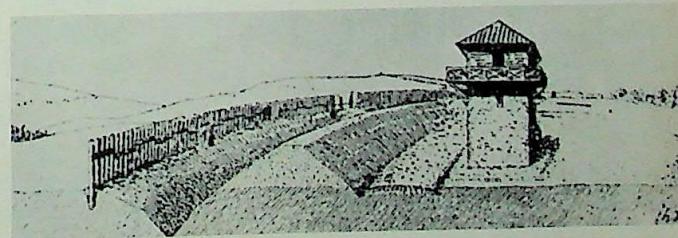
on the conditions or the Teutons and the Romans, the limes was definitely a separation, for this boundary, consisting in part of wooden stakes and partly of stone blocks, went all the way from the un-dernach on the Rhine almost to the gates of Regensburg. It included 60 large fortresses, a multitude of outposts, and more than 900 lookout towers.

Afford to several Roman emperors had their legions toil over the construction of this boundary system, and when the political situation demanded it, the military administration in far-off Rome moved the boundary line. It began with a series of fortresses on the upper Rhine and the Danube. Emperor Domitian then moved the boundary to the Neckar in 85 A.D., and Emperor Trajan (98–117) continued it by having the Odenwald limes built: it was a chain of lookout towers and small fortresses. Around the middle of the 2nd century, the Romans moved the Neckar-Odenwald limes about 30 kilometers to the East, to a line between Miltenberg on the Main and Lorch, east of Stuttgart. At the beginning of the 19th

century, the Roman-Germanic Commission of the German Archaeological Institute, which has its seat in Frankfurt, reports in the commemorative book, "Der römische Limes in Deutschland" ('The Roman Limes in Germany' – Theiss Verlag, Stuttgart 1992), scholarly study of the limes began in the German states. At that time, historical associations excavated fortresses with much idealism and published their discoveries and findings. Limes fever had broken out in Germany. In the second half of the previous century, the German state governments then entered the limes-research scene, financing excavations and establishing limes commissions. At the time, the world-renowned ancient historian and expert on the Romans, Theodor Mommsen, complained that there were

by then "as many limes literatures as participating states." He therefore proposed charging a national commission of experts with the scholarly study of the limes once and for all. In January, 1892, the Reich Diet in Berlin finally approved the necessary funds for a "Reich Limes Commission," with Mommsen as its first chairman. In June of the same year, the new commission convened for the first time in Heidelberg, where archaeologists, historians, local historians and retired officers gathered. Their goal was "the scholarly study of the limes," the publication of results, and a report to the Reich Chancellor.

But the chancellors of the Reich came and went – not always to the benefit of the Reich and the limes. Some 40 years after the founding of the Reich Limes Commission, its end seemed nigh: in Germany the National Socialists were in power, and they were more interested in the Teutons than in the monuments of the Romans. At that time field research came to a nearly complete standstill; there were less and less publications on the limes, and finally they stopped completely. In 1939, the final blow came: in October, the Minister for Science, Education, and Popular Enlightenment dissolved the



The path of the limes runs for over 500 kilometers right across Southern Germany.
(Photo: Ullstein)

Commission, which had outstanding achievements to its credit.

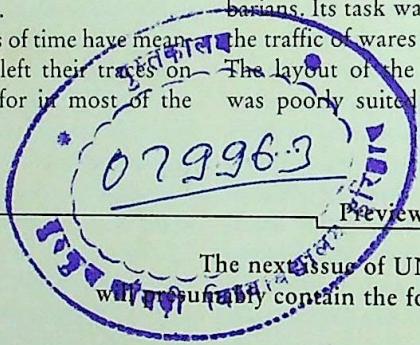
After World War II progress in limes studies was slow at first. The first excavations on a larger scale were performed by the Roman-Germanic Commission and the Saalburg Museum in Bad Homburg. These excavations were funded by the German Research Foundation (DFG). In the sixties the archaeologists made a particular study of the fortresses in the hinterland of the limes, and in the eighties the State Monument Bureau of Baden-Württemberg began a systematic study of the Roman civilian settlements.

The ravages of time have meanwhile also left their traces on the limes, for in most of the

areas in agricultural use, the traces of walls, moats, and the Rhaetian Wall, which were clearly visible until a few decades ago, have vanished, as have many fortress and look-outtower sites. Home builders and intensive agriculture have destroyed many Roman monuments along the limes for good.

Limes studies have corrected several historic errors in the course of decades: today we know that the limes was not a line of defence such as Hadrian's Wall between England and Scotland, but a line of demarcation between the Roman Empire and the Germanic barbarians. Its task was to control the traffic of wares and people. The layout of the limes itself was poorly suited to defence

purposes, as many of its segments could not even be seen by the guardposts, and in addition the terrain in front of it could not be reached by weapons for throwing or shooting in many places, due to blind spots. Even the "Rhaetian Wall," which was once two meters high and was erected between Lorch and Eining, near Regensburg, was only a "fake": it had no sentry walk from which it could have been defended. Palisades and the stone wall were merely an obstacle to anyone approaching. They made crossing the border more difficult, but they couldn't prevent it. The Teutons finally noticed this, too, and stormed the putative bastion in several offensive waves in the 3rd century.



The next issue of UNIVERSITAS
will hopefully contain the following contributions:

Ecology

The Open Process of Nature
Günter Altner, Heidelberg

Ethics

Is Something All Right Just Because It Can Be Done?
Risk Assessment as Exemplified by Genetic Engineering
Dieter Birnbacher, Essen

International Relations

Islam and the Human Rights
Bassam Tibi, Göttingen

Politics

Si Vis Pacem, Para Pacem
Dieter and Eva Senghaas, Bremen

Sociology

On the Way to a New, High Quality Illiteracy?
Wilfried von Bredow, Marburg

Psychology

Auto-Mobile or the Self in Traffic
The Psychoanalysis of Car Abuse
Micha Hilgers, Aachen

its seg-
be seen
in addi-
nt of it
y weap-
hooting
to blind
Rhaetian
two me-
ected be-
ng, near
l "fake":
lk from
been de-
he stone
stacle to

They
der more
couldn't
s finally
stormed
several
3rd cen-



